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NOTES FOR THE MONTH.

Foot-and-Mouth Disease: The Ministry's Policy.

The present policy of the Ministry in dealing with foot-and-mouth disease is the stamping-out policy, *i.e.*, the extermination of the virus of the disease by the immediate slaughter of all affected animals and of all other animals which, owing to their close contact with the former, are certain to become infected. As the virus of the disease from an affected animal can be carried long distances on the feet of other animals, or on the feet and clothes of persons, and even by birds, and may possibly be air-borne, the prompt disposal of affected stock by slaughter is considered the most effective means of eradication, particularly in an island country like our own possessing the natural protection afforded by the sea against the re-introduction of infection by direct contagion.

Exception is, however, made in the case of pedigree stock, valuable not only intrinsically but also from their Herd or Flock Book position. The local circumstances in these cases are often specially favourable to successful isolation, and this class of case presents little difficulty.

The position of Great Britain may be compared with that of certain other countries which enjoy periods of freedom, or comparative freedom, from foot-and-mouth disease, viz., Canada, Australia, New Zealand, the United States of America, Norway and Sweden. These countries, like Great Britain, either prohibit the entry of livestock or protect themselves with drastic quarantine laws against the entry of diseased animals. The first three countries have been entirely free from foot-and-mouth disease for many years. The United States and Sweden have adopted the slaughter policy and it may be assumed that the above-mentioned British Dominions and also Norway would adopt this policy if invaded by the disease.

Other countries in Europe, Asia, Africa and America deal with the disease by isolating infected stocks, regulating stock

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movements within their boundaries and quarantining the animals they import, or alternatively let the disease take its course without interference. Denmark and Holland periodically free themselves from the disease but become re-infected from neighbouring countries.

Comparative Cost of Slaughter and Isolation.—*Slaughter—Great Britain.*—The Ministry has adopted the policy of slaughter since 1892, and the country has since that year enjoyed considerable periods of freedom from the disease, viz., from 1895-1899, 1903-1907, 1909 and 1917. Every fresh invasion has been dealt with rapidly by slaughter, at a total cost of £948,176 in compensation for animals slaughtered during the 31 financial years ended 31st March, 1923. Estimating the total value of the animal stock of Great Britain, consisting at June, 1923, of 7,013,025 cattle, 20,598,331 sheep, and 2,796,531 pigs, at about £300,000,000, the compensation is equivalent to the payment by the State of an annual insurance premium of about £30,000, or 2½d. per £100. If the last two years (1922-23), which can justifiably be regarded as abnormal, are excluded, the average annual cost of keeping the country free from the disease by the slaughter policy was little more than £9,000.

It has been contended that the slaughter policy seriously depletes the livestock of the country. The adoption of that policy in 1922 (the worst year since 1884) involved the slaughter of 24,071 cattle, 21,831 sheep, and 9,821 pigs. These figures represent but a very small percentage of the total number of animals of each class in Great Britain, viz., cattle, 0·35 per cent. (or 35 per 10,000); sheep, 0·1 per cent. (or 1 per 1,000); and pigs, 0·36 per cent. (or 36 per 10,000).

The numbers of animals which have been slaughtered, or have been authorised to be slaugthered up to 20th December in connection with the present outbreak are 47,388 cattle, 20,747 sheep, and 24,999 pigs. The percentage relation of these figures to the livestock population is cattle, 0·67 per cent. (or 67 per 10,000); sheep, 0·1 per cent. (or 10 per 10,000); and pigs, 0·90 per cent. (or 90 per 10,000). So far, therefore, as their effect upon the livestock population is concerned, the number of animals slaughtered is negligible. It may be observed that the figures above quoted representing the livestock population in June, 1923, are, notwithstanding the adoption of the slaughter policy in 1922, the highest figures recorded for the past 4 years in the case of cattle, for the past 5 years in the case of sheep, and for the past 12 years in the case of pigs.

The *United States* suffered a severe visitation in October, 1914, after a period of five years' freedom. In this case the disease spread in three months to 210 counties in 18 separate States. As the Chicago stock-yards became infected the position appeared desperate, but the United States Government did not hesitate ruthlessly to slaughter every affected animal and succeeded eventually in clearing the country of the disease by May, 1916, at an expenditure of £1,500,000, equivalent at the present day to an expenditure in this country of not less than £2,500,000. Since the year 1916 the United States has been free from the disease.

Isolation.—Great Britain (1870-1884).—The annual loss from mortality and from deterioration in flesh and milk of affected animals in the countries which adopt isolation in lieu of slaughter can only be vaguely estimated. Reference to early reports concerning the disease in Great Britain shows that the losses through deaths, depreciation in affected animals, loss of young stock, loss in milk and butter, and in other necessary expenses, in the counties of Cumberland and Westmorland, for which an estimate exists during seven years preceding 1878, were not less than £43,000 per annum. If this estimate be extended to the whole of Great Britain, the annual loss through the disease at that time would be put at about £1,500,000 per annum in the lower values of that day. It may be mentioned, in passing, that after 1878 in these two counties a policy resembling our own present policy of slaughter was put into force, and seven outbreaks only of the disease occurred in the next six years. In each of these outbreaks the disease was prevented from spreading beyond the farm or premises in which it appeared, and this at a time when much disease was prevalent in the country as a whole.

Holland.—The Ministry is informed that a policy of slaughter was attempted in Holland a few years ago, but that this was abandoned when the expenditure reached £500,000. It was subsequently found that the annual loss to farmers from the disease being allowed to gain a footing through the adoption of the isolation policy reached £2,500,000.

France.—It is estimated that the losses in France, where the isolation and treatment policy is adopted, amounted in a recent year to at least £5,000,000.

Stock Movement Restrictions. — *Slaughter.* — By rapid slaughter and disinfection, the inconvenience and loss to farmers due to restrictions on movement are reduced to a minimum, as this policy enables the restrictions to be withdrawn

after a comparatively short period, usually about five or six weeks in the case of an ordinary outbreak, except on the infected place itself, where the restrictions are maintained for two months, or six weeks from the completion of disinfection.

Isolation.—With the adoption of isolation it would be practically impossible, judging from Continental experience, to prevent the disease spreading and becoming endemic. Restrictions on movement and marketing of all stock within 15 miles of an outbreak would be imposed—as under the present system—and they would have to be maintained so long as active centres of the disease existed. This would mean the maintenance of restrictions for long periods over large areas. The movement of stock from the infected farm, and in some cases from adjoining farms, would have to be prohibited for probably six months. Even then, all danger of recovered animals affecting any susceptible animals with which they come in contact would not have entirely ceased.

In Switzerland all animals after recovery from an attack are branded and may not be mixed with unbranded stock for eight months.

Great Britain is more unsuitable for an isolation policy than the Continent, as in this country sheep stock greatly preponderate and these cannot be successfully isolated, as in many districts they run together in thousands on common pasture ground.

Export Trade in Pedigree Stock.—The export trade of this country in pedigree stock is a very important and valuable one. In the four years, 1918, 1919, 1920 and 1921, the average annual value of the export trade in cattle, sheep and pigs was £700,175. Foreign Governments impose restrictions on the importation of stock from Great Britain when disease exists and the export trade in 1922 was on this account reduced in value to £230,925. If disease became endemic, as it almost certainly would under a policy of isolation, the export of pedigree stock to those countries which have been our best customers would cease.

General Conclusion.—If the policy of isolation and treatment could be made effective, it is reasonable to conclude that such would have been the result in Continental countries such as France and Germany. Those countries have, however, failed to prevent the disease spreading and becoming endemic.

The abandonment of the policy of slaughter in favour of one of isolation and treatment in Great Britain would be tantamount to admitting that notwithstanding the natural protection afforded by the sea, this country must in future place

itself on a level of equality with other Western European countries as regards foot-and-mouth disease. The disease could not be prevented from becoming endemic, and the losses and inconvenience to farmers and livestock traders which would result from the disease and from the operation of restrictions imposed, not only by the Central Authority, but also by the various County Authorities, would become permanent, and the internal trade of the country in stock would suffer considerably.

The average annual losses to the country might easily reach as high as £2,000,000, compared with the average annual cost of £30,000, incurred in carrying out the slaughter policy during 31 years.

Finally, this country would lose its pre-eminent position as regards the export trade in pedigree stock.

Opinion of Departmental Committee of 1922.—The Departmental Committee which enquired into the widespread outbreak of foot-and-mouth disease in 1922 stated in paragraph 100 of their Report (Cmd. 1784) dated 7th December, 1922, as follows:—"We are in agreement with the majority of the witnesses who have stated their opinion that the policy of slaughter is the correct one and should be maintained."

Relation of Question of Isolation to the Outbreaks of 1923.—The present series of outbreaks commenced at the end of August, 1923. One very disturbing feature has been the number of apparently unconnected centres of the disease established in widely separated localities, in which Scotland as well as England has been involved; another is the extraordinary rapidity with which infection has spread from farm to farm in the North Midlands Area (Cheshire, Salop, Denbighshire and Flintshire). Until the third week in November the new centres (with the exception of the Cheshire Group) were by the established method of slaughter being quickly stamped out, and no fewer than 16 of those centres no longer exist. On the 18th November, however, some pigs moved to Newcastle from premises in Scotland on which foot-and-mouth disease was discovered three days later contaminated the loading docks at Newcastle and also the markets at Newcastle and Gateshead on the 19th and 20th November. Infection was picked up in those places and taken to certain other markets and thence to numerous farms in Northumberland, Durham, Yorkshire, Derbyshire, Nottinghamshire, Staffordshire and Leicestershire. This unfortunate occurrence was the direct cause of some 160 further outbreaks and materially increased the difficulties of eradication. There is now nevertheless reason to think that all

known centres of infection, except that in the Cheshire Group, are well in hand. In the latter, however, the disease continues to spread, at the date of going to press, at the rate of more than 20 fresh farms daily.

The problem has now resolved itself largely into one, firstly, of checking further spread of the disease in the Cheshire Group, and preventing its escape from that area, and, simultaneously, of securing the elimination as quickly as possible of other centres of infection still existing and also of those which may yet appear. Both of these objects would be retarded by the adoption of isolation of affected animals, which would mean the upkeep of large numbers of centres for the manufacture of fresh virus and expose the remainder of the country to the danger of re-infection. If such a procedure were applied to the Cheshire area—

(1) the area would have to be isolated from the rest of the country for many months;

(2) it would be impossible to re-stock farms now empty for an indefinite period, as the animals would almost certainly fall with the disease; and

(3) its milk and dairy products would be enormously interfered with.

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Warning Against Hay and Straw Used for Packing.

THE Ministry desires again to call attention to the possible risk of foot-and-mouth disease being transmitted to flocks and herds in this country by means of hay and straw used for the packing of foreign imported goods.

This question was considered by the Departmental Committee appointed by the Minister in 1912 to inquire into foot-and-mouth disease in Great Britain. In their Report, that Committee pointed out that numerous imported articles are packed in hay and straw, and that a large proportion of this packing ultimately reached the farm as manure. That Committee considered, and the Departmental Committee appointed in 1922 supported the view, that hay and straw used for packing constituted a possible medium for the introduction of disease into the country, but in view of the serious dislocation of general trade which the prohibition of its use would entail, neither Committee was prepared to recommend the issue of restrictions to that end.

All persons using such hay and straw are, however, warned of the element of danger which it contains, and of the risk of allowing it to come in contact with any animals.

Agricultural Returns, 1923.

THE Ministry's annual report on the acreage of crops and number of live stock in England and Wales in 1923 has now been published. Preliminary figures for the whole country were issued in August, see page 569 of this *Journal* for September, but the appendices to the annual report give the finally revised figures for each county.

The chief changes in cropping as compared with the previous year are discussed in the report, and a table is included showing the distribution of arable land among the different crops over a period of years. The efforts made this year to obtain data as to fruit which will afford a better basis for estimating the total production are dealt with at length. The returns of the number of orchard trees show that there are nearly 22,000,000 fruit trees on agricultural holdings in England and Wales.

In the report on live stock a table is included which shows that over a long period of years the supply of cattle for beef production has been practically stationary, the increase in the total number of cattle being almost wholly due to the increase in milk production. A similar table as regards sheep indicates that whereas in Wales the number of sheep per 1,000 acres has increased in the past forty years, and in the north and north-west of England there has been no great decline, in the eastern counties there were only 173 sheep and lambs per 1,000 acres in June, 1923, against 564 in 1875-79.

Returns of the number of agricultural workers employed on 4th June, 1923, are also included in the report. These show that between June, 1921, and June, 1923, the number of regular workers on agricultural holdings declined by 59,952 or nearly 9 per cent.

The Report, which forms Part I of the Agricultural Statistics, 1923, is published by H.M. Stationery Office, and may be purchased through any bookseller or from the Stationery Office Sale Office, Kingsway, W.C.2, price 1s. 6d.

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Closing of the Cattle Testing Station, Pirbright, Surrey.

THE Ministry desires to announce that the Cattle Testing Station at Pirbright, Surrey, will be closed as from the 1st March, 1924.

Hitherto exporters of cattle to South Africa have been required under the regulations of the Government of the Union of South Africa to place their animals at the Pirbright Station for 28 days quarantine prior to the application

of the tuberculin test immediately before exportation. In view of the closing of the Station, no more animals will be received there. Animals already at the Station will complete their quarantine and testing there before export, and will not be tested again on arrival at South Africa, provided that they are accompanied by the usual certificate from the Ministry that they have passed the tuberculin test at the Station.

In regard to the cattle not admitted to the Pirbright Station, it is observed that under the present regulations of the Union of South Africa cattle imported from countries from which importation is not prohibited and in respect of which no arrangement has been made for quarantine and test at a Government Testing Station are required to be quarantined for at least 28 days and subjected to the tuberculin test at the port of entry. Any animals which react to the test may be destroyed without compensation, or the owner may be required to re-export them to the country of origin at his own expense.

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Report on Animal Diseases.

THE Annual Report on Animal Diseases in 1922, by Sir Stewart Stockman, the Chief Veterinary Officer of the Ministry, has now been published. It is of special interest on account of the history which it gives of the outbreak of foot-and-month disease in 1922, the largest and most widespread since 1884. The outbreak commenced in January, 1922, at Hull and Newcastle, and spread in the course of six months to 1,125 premises in 30 counties in England, 1 in Wales, and 13 in Scotland. Charts are included which show the progress of the disease, and the chain of infection of markets in January to which its spread was mainly attributable.

The report also includes a *résumé* of the general conclusions of the Departmental Committee appointed under the chairmanship of the Rt. Hon. E. G. Pretyman, M.P., to inquire into the origin and circumstances of the outbreak, and the policy and procedure pursued in connection therewith, and to report whether any alteration of the methods of administrative control or of the existing law is necessary or desirable.

As regards other animal diseases, the report shows that continued progress was made towards the eradication of glanders, that there was an appreciable decrease in the number of outbreaks of sheep scab, and that only half the number of cases of parasitic mange in horses occurred during 1922, as compared

with the previous year. On the other hand, outbreaks of swine fever and anthrax showed an increase.

The second part of the report is occupied by an account of the measures taken to prevent the introduction of disease from abroad, and to protect animals from avoidable suffering in transit by land and sea, notably in connection with the exportation of horses to the Continent. It includes a summary of the events of the year leading up to the passing of the Importation of Animals Act of December, 1922, which permitted the importation of Canadian store cattle.

The report concludes with a record of the work at the Government Cattle Testing Station, Pirbright, and of the diagnostic and other business transacted at the Veterinary Laboratory, New Haw, Weybridge. Copies are obtainable through any bookseller, or directly from H.M. Stationery Office, Kingsway, W.C.2 (or Manchester, Edinburgh, and Cardiff), price 3s. 6d. net, post free 3s. 7½d.

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The Government Pavilion at the British Empire Exhibition, 1924.

THE following note describing the Government Pavilion at the British Empire Exhibition has been issued by the Exhibition Authorities. The Pavilion will include an Agricultural Section in regard to which information will be given in subsequent issues of the *Journal*.

"For the British Empire Exhibition, which will open at Wembley in April next, the British Government is erecting a Pavilion of appropriate dignity of structure and design. The Royal Suite for the use of the King and Queen will overlook the portico, which will be supported by columns thirty-two feet high, and will be guarded by six massive lions, symbolical of the might and dignity of the Empire. The navy, army and air force are organising impressive displays, and many important aspects of Empire communication, trade, and settlement, and Imperial economic development will be presented. On a water stage seventy feet wide, which, by an ingenious mechanical arrangement, can be converted in a few minutes into an ordinary stage for other displays, certain historical episodes on sea and land and in the air will be realistically reproduced. The Air Force exhibition of models will be supplemented by exhibits of actual aeroplanes and aircraft in an aerodrome easily accessible from the Exhibition grounds. In the Central Court of Honour of

the Pavilion a gigantic model relief map of the world will show by changing lights the growth and extent of the Empire, its resources, development and population. The home country's productive capacity in relation to its ability to manufacture goods for export, and the importance of British overseas trade, will also be illustrated by a large scale model of Great Britain and Ireland. In an annexe there will be a cinema theatre where films of Imperial interest will be in continuous display. The Royal Mint, which will show a complete set of coins of the Empire and of British war medals, will strike special commemorative plaques. The Post Office exhibit will illustrate the most up-to-date methods in the organisation of postal services as well as the recent developments in telegraphy, telephony and wireless communication. Medical and scientific research will be illustrated, and an important exhibit will be that relating to tropical health and hygiene. The Empire's contribution to the progress of modern science, both pure and applied, will be shown by the Royal Society in a manner likely to appeal to the popular imagination. The Ministry of Health, Ministry of Agriculture, Mines Department, Imperial Mineral Resources Bureau, Royal Botanic Gardens at Kew, and the Geological and Ordnance Survey will all be attractively represented."

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Conciliation Committees in Agriculture.

THE Denbigh and Flint Committee has agreed that wages shall remain unchanged until 30th April next. The rates are 33s. for 61 hours for adult horsemen and stockmen, and 27s. 1d. for 50 hours for other adult male workers. Provision is also made in the agreement for payment at proportionate rates to certain juvenile workers, and for a weekly half-holiday whenever possible.

A further wages agreement has been reached by the Carnarvonshire Committee. The terms, which are to remain in force until 18th May next, are as follows for male workers over 20 years of age:—

Special Class Workers living out.—35s. for a week of 61 hours (to include the Sunday feeding and cleaning of stock). *Special Class Workers boarded and lodged on farm.*—33s. 6d. for 61 hours, the deduction in respect of the provision of board and lodging being reckoned at 14s. for 7 days and 12s. for 6 days.

Other Workers.—30s. for a 50-hour week.

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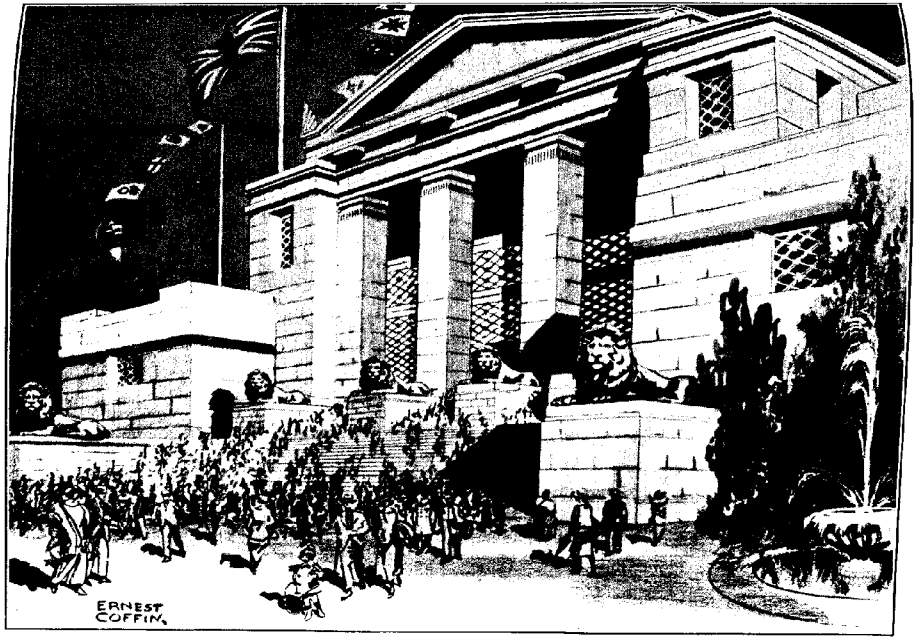
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CO-OPERATIVE MARKETING IN THE UNITED STATES OF AMERICA.

Recent developments in co-operative marketing in the United States seem to mark an epoch in agricultural organisation. As in other countries the movement has passed through an experimental stage, a period of trial and error, out of which it now seems to have emerged with certain definite principles which are the direct result of practical experience. During the past few years, the progress has been most striking, and it is hardly too much to say that co-operative marketing is at the present moment the dominant movement in American agriculture.

Co-operative marketing in the United States started with dairy produce in the early part of the 19th century. It passed through a phase when it formed part of what was known as the "Grange Movement" founded in 1867, and the period between that year and 1880 saw the rise and fall of innumerable co-operative enterprises engaged in the marketing of grain, cotton, livestock, tobacco, wool and other produce. A failure to meet the real economic needs of agriculture, combined with radical mismanagement, brought this movement to sudden collapse, just as in Europe the application of the "Rochdale" principles to the marketing of farm produce—*i.e.*, the marketing of a large number of agricultural products through one association—led to an almost equally conspicuous failure.

Governing Principles.—In its subsequent development, there have by degrees become recognised certain governing principles which may briefly be summarised as follows:—

1. The organisation of sale must be on a "commodity" basis and not by locality, that is to say, whilst there must be local organisation for receiving, packing and grading, the organisation as a whole must cover a wide producing area, and the local units must be federated in one central body in order to secure adequate control of the market.

2. The supply of produce must be regulated by binding contracts under which the growers pledge their produce to the association for a term of years.

3. The products must be pooled according to size, grade or other characteristic, so that whilst individual growers obtain returns in proportion to the amount and quality of their produce, the organisation of sale passes from these thousands of individual growers into the hands of one organised unit.

How these principles came to be evolved may be illustrated by examples from what actually occurred.

1.—Growers of citrus fruit (mainly oranges) were among the pioneers of the American co-operative marketing movement. The first attempt at co-operation in this trade dates back to the early days of commercial orange production on the Pacific Coast. Between 1877 and 1890 there was a very rapid development in the orange trade in California which soon resulted in "over-production"—there was a "boom" which was speedily followed by a general fall in prices. After an abortive attempt at self-protection through the agency of the Orange Growers' Protective Union, the growers turned to co-operation. The actual beginning was marked by the organisation of the Pachaffa Orange Growers' Association in 1888. Other local associations quickly sprang up, and succeeded in securing fairly good prices in the years immediately following, and during the early 'nineties. They were, however, hardly more than local marketing agencies disposing of their members' fruit in each district independently.

The next step was the establishment of district exchanges in each of the chief producing areas operating in conjunction with the local growers' associations. The organisation of local associations and district exchanges, however, was not enough. It gave the growers no real control over the marketing of the fruit, the associations competed against one another, and the market still tended to be flooded at the time of harvest, and prices to be depressed. Growers therefore sought to federate the local associations into one central body, and ultimately, in 1905, the Californian Fruit Growers' Exchange, the central marketing authority for the united organisation, was established. Thus the last link in the chain came to be formed; federation proved to be the way to success, and with the advent of the California Fruit Growers' Exchange the co-operative organisation for the first time obtained a commanding position in the market. This exchange has dominated the market practically since its inception, and with its formation the general structure of the marketing organisation, viz., local associations —district exchanges—central exchange, was complete. Upon this pattern the whole organisation as it exists to-day has been built up. At present there are 10,700 growers each contracting to deliver the whole of his fruit to the local association. There are 206 local associations concerned primarily with grading and packing, 19 district exchanges whose chief function is

directing the fruit received from the local association to the markets, and finally the central co-ordinating body, the California Fruit Growers' Exchange. Upon the latter by reason of its commanding position falls the task of controlling distribution, of preventing congestion, and thus of securing to the grower what is the real achievement of co-operative organisation—a stabilised market.

2.—The second of the principles referred to above, viz., long-term producers' contracts, was evolved largely as a measure of self-protection. Many co-operative enterprises had in the earlier stages of their existence to withstand attacks from private dealers who endeavoured to tempt producers out of the co-operative organisation by offering high prices for their produce. It was precisely this difficulty which confronted the Danish co-operative movement in its earlier years, in fact, the long-period producers' contract applied to co-operative marketing, is a Danish invention, from which country it was adopted by the United States. Producers' contracts were first used in America by a Farmers' Elevator Co. in Iowa in 1889: they were adopted by the California orange trade in the early 'nineties, and at the present time have become almost the only practice of co-operative undertakings in that country.

The advantage of the contract system, however, is not confined to eliminating the disruptive attacks of outside dealers. It also adds greatly to the power of the co-operative organisation to control the markets, since the volume of produce to be handled is fixed within comparatively narrow limits, thus enabling the marketing policy to be developed with a fairly definite knowledge not only of the present but of the future supplies of fruit to be handled.

3.—The principle of "pooling" has, with a few exceptions, also become the recognised practice of American co-operative marketing associations. Here again its adoption has been the outcome of practical experience. It has been found that both cheapens the operations of grading and packing, and nables an association to establish a reputation for its products n the market, to reduce wastage to a minimum, and to handle he various grades more easily. Pooling usually consists not nerely in the physical mixing together of the growers' produce ccording to grades, but in the transfer of the control of sale ombined with a proper distribution of the profits realised mongst the members of the association. It greatly facilitates, indeed it is essential to, the exercise of the association's full

powers of control over the movement of produce to the market, and it has consequently come to be recognised as one of the primary instruments of market stabilisation. Pooling in this sense is not, however, invariable.

Economic Difficulties.—With co-operation established on these guiding principles, American agriculturists have sought to apply it on a wider scale, in remedying the specific economic difficulties which beset the marketing of agricultural produce. These are principally three in number: (1) Seasonal fluctuations in prices; (2) Fluctuations in prices due to temporary excess of supply over demand, *i.e.*, in consequence of exceptionally heavy crops; and (3) Wastage due to deterioration.

In order to overcome these difficulties, the recent development of the co-operative marketing movement has aimed not merely at eliminating the middleman and replacing him by a co-operative society—the advantage of which to the farmer is at best small, and often negligible—but rather at putting into the farmer's hands an effective instrument by which he can prevent or at least minimise violent fluctuations in prices.

That the seasonal drop in prices at harvest time is largely due to financial causes (*i.e.*, to the farmers' need for ready cash) is well recognised. In the United States it has been estimated that only 12 per cent. of the farmers are able to finance their own crop raising. Consequently the practice of unloading their produce on to the market at the earliest opportunity, both in order to raise money to meet their current obligations and to provide for subsequent operations, has been widespread amongst growers in every branch of agriculture. Of the cotton crop 70 per cent. is said to be dumped on the market by farmers during the period, September-December, and 65 per cent. of the wheat is marketed between the beginning of August and the end of November.

The farmer's need to raise cash on his produce lies at the root of the whole question; it is from one point of view the crux of the marketing problem, and it is because in the past—in a system of unorganised competitive marketing—he had no course open to him but to sell his produce outright for what it would fetch, that he remained a helpless victim of the seasonal slump in prices which not infrequently fell below the cost of production.

Control of Produce, and Bank Credits.—To meet these difficulties American co-operators have primarily endeavoured to secure two things: (1) the physical control of the movement of

duce to market on the lines which have been described above, an extent which gave the co-operative organisation a pre-minant position in the market; and (2) power to obtain bank vances by using the commodities themselves as collateral urity. In practice this has involved an intermediate stage tween the producer and the consumer in which the product put into store—in the case of certain perishables into cold rage, and in the case of non-perishables into warehouses or her stores. Upon warehouse receipts the banks have been dy to make advances to co-operative marketing associations, the same lines as has for many years been their practice in e case of wheat stored in elevators and cotton in warehouses. he association is thereby enabled to make an immediate advance the growers—up to 50 or 60 per cent. of the market price—nd still to retain control of the rate at which the produce is oved to the market. The development of this side of marketing perations has led to a considerable extension of the use of credit s a means of securing stabilisation of prices, and in the crisis hich followed the general slump in prices in 1920 this machinery roved to be of the highest importance.

In 1922, the War Finance Corporation, a State credit institu-ion with a capital of $500,000,000 created and guaranteed by he United States Government, was resuscitated, largely for the purpose of assisting agriculture over the crisis. During the season 1921-22 the Corporation authorised loans amounting to $64,000,000 to co-operative marketing associations, and in the following season similar loans were approved to the extent of $114,000,000 "to assist in the orderly marketing of the 1922 crops."

One quotation may be given from the annual report of the War Finance Corporation for the year ending 30th November, 1922, to illustrate the effect of these operations.

"In the midst of the worst depression that the cotton industry has suffered in many years it was through the co-operative marketing associations that the War Finance Corporation developed plans for extending assistance to the industry on a comprehensive scale. In the summer of 1921 when . . . . business throughout the Cotton Belt was in a demoralised condition, the corporation made its first loan to an association in Mississippi on 100,000 bales of cotton. The cotton was classified by the association according to grade and staple, and placed in bonded warehouses. . . . The loan enabled the association not only to make advances to its members for their urgent financial

needs, but also to market the crop through a greater portion of the consuming year, instead of forcing it on a demoralised market."

Co-operative marketing plus State credit, proved in the period of crisis to be a means of stabilising the market, of preventing panic, and of restoring confidence, which was of almost incalculable benefit to farmers, and as a direct consequence of its success, a new impetus was given to the co-operative movement itself under which many new marketing associations were organised for handling cotton, wheat, tobacco, rice and other staple products.

Turning to the other aspect of the question—the control of the physical movement of produce to the market, the most significant development in this direction has occurred in the case of perishables. In those organisations where the development towards federation has reached the point of giving them a dominating position in the market, control of the movement of produce has become a systematised practice. Although production necessarily varies with seasonal conditions, it has become possible, through co-operative enterprise, to secure that the rate of delivery to market is determined by the demand of the market and no longer by the rate of production. Thus, in the case of butter and cheese the rate of production rises during the first half of the year to a maximum in June and thereafter declines to a low point in December, whilst the rate of consumption is relatively steadier throughout. From about the middle of April to the end of August there is consequently a definite "into storage" period during which the association receives from producers more than it sells, and from the beginning of September till the middle of April an "out of storage" period during which these conditions are reversed. Thus the market is supplied according to its needs and fluctuation in prices is reduced to a minimum.

Marketing of Wheat.—In recent months much attention has been directed by American agriculturists to what is perhaps the greatest marketing problem in the world—that of wheat. Both on account of the widespread depression of wheat prices and of the predominant importance of wheat amongst the agricultural products of the United States the present position in regard to the problem of orderly marketing of the wheat crop of America is one of exceptional significance. The marketing of wheat in the United States is a highly organised business. The system of bulk handling, storage in elevators, and bank credits, combined with highly skilled technical management,

has led to an organisation in some respects without parallel in the world. It is, however, not an organisation built up on the principles which American agriculturists have now come to know as "orderly marketing"; it does not embody those elements by which alone stability of prices can be secured. Fundamentally the wheat organisation has been developed round the "speculator"—the person who buys from the farmer at harvest time when the grain comes into the market in a greater volume than the current consumptive needs, and sells it again after the flood is over. To the speculator fluctuations in price are not necessarily an evil and may be a source of considerable profit.

The movement for the co-operative ownership by farmers of grain elevators has in the past years undergone considerable development, but its success has necessarily been only a partial one. It has enabled farmer members to obtain credit on their produce, and to this extent has rendered an important service, but it has not achieved its ultimate object. The flow of grain to market still continues in a disorderly fashion and prices tend to fluctuate as widely as ever. The bulk of the crop is still sold by farmers soon after harvest, and the farmer has to be content with what he can get.

The continued depression in wheat-growing districts and the increasing political pressure which was being brought to bear on the United States Administration recently led the President to appoint a Commission consisting of Mr. Eugene Meyer, Jnr., and Mr. Frank Mondell, of the War Finance Corporation, to investigate the wheat situation. The Commissioners examined various proposals, and their conclusion is significant: "Co-operative marketing associations organised along sound lines and with competent management and business guidance, offer, at the present time, in our opinion, more promise of helpful results than any other plan or programme that has been suggested. They can do what the speculator cannot with safety be relied upon to do. They can by orderly marketing regulate the flow of wheat so that supply is adjusted from time to time to the consumptive demand."*

Co-operation is daily becoming more widely recognised in America as the cure for fluctuations in wheat prices. What has been wrong is partly that the principles of co-operative marketing have not been strictly applied in the case of grain,

* Report to the President on the wheat situation, by Eugene Meyer, Jnr., and Frank W. Mondell.

and partly that the practical difficulties are greater than in other branches of agriculture. With greater knowledge of the economic conditions of grain marketing, however, there would seem every reason to believe that these difficulties will eventually be overcome. The progress of organisation of wheat marketing in the United States during the next few years cannot but form one of the most interesting, possibly one of the most far-reaching experiments in co-operation in any country in the world.

Co-operative Marketing of other Produce.—It would be beyond the scope of this article to describe how these principles have been applied in other branches of agriculture, but there is no doubt that the success of the co-operative marketing movement* during the critical period of 1920-1922 has been the reason of its subsequent very rapid growth. In 1922 the turnover of American co-operative marketing enterprises exceeded one thousand million dollars—a five-fold increase within a decade. Most of the principal farm products are now successfully marketed through co-operative organisations, ranging from a small proportion of poultry and vegetables up to 75 per cent. of American-grown citrus fruits, 90 per cent. of dried fruits, 70 per cent. of tobacco, while they also deal with 25 per cent. of milk and milk products, and 20 per cent. of cotton. In all about 1,200,000 farmers belong to these commodity organisations, the cotton associations of the Southern States—to take an example—having a membership of more than 200,000. In regard to the latter it has been stated that every member who marketed his crop last year through a cotton association received at least $20 per bale more than the non-members received for the same grade and quality of cotton.

In conclusion, two quotations may be given from a book† on which much of the information in this article is based:—

"Intelligent merchandising of farm commodities through co-operative associations leads finally to a stabilised agriculture, in which fluctuations in prices are minimised, risks of operations greatly reduced, and a premium placed upon the farmer's ability as a producer."

"The farmer retains his individualism as a producer, but he puts group selling to work as his sales manager. Neighbour

* See the *Statist* article on "The Growth of American Co-operative Marketing," 24th November, 1923, p. 710.

† "Co-operative Marketing: The Golden Rule in Agriculture," by Herman Steen, American Farm Bureau Federation Library; Doubleday, Page & Co.

joins with neighbour, they pool their product, each man has one vote in the control, and they share and share alike in a new system of economic justice for agriculture."

* * * * * *

PIG-KEEPING.

V.

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General Principles in the Construction of Pig Sties—Shelters for Open Air Pig-keeping—Fencing—Appliances for weighing Pigs.

Permanent Pig Sties.—It has been pointed out by Mr. Sanders Spencer that pig sties may be described as of three kinds—those which are ornamental, those which are useful, and those which are neither one nor the other. It has been our experience that the conventional type of sty usually belongs to the third class. Pigs, however, do not require elaborate or expensive housing. It is not within the scope of this article to deal in detail with the planning of modern piggeries, but certain broad principles which should be observed in their construction would appear to bear repetition, as they are by no means uncommonly neglected.

The main points of importance in a pig sty are that it should protect the pig from excessive cold and heat, from rain and draughts, and more particularly from cold winds from the north and east. It should be well ventilated and airy. Sun is one of the best germicides and it will help to maintain healthy conditions if the sun's rays can penetrate to all parts of the sty in the course of the day. On the other hand, it will be found a great advantage in hot weather if some simple means of excluding the sun's rays is also provided. Wooden shutters on hinges might serve the purpose in certain circumstances. Many sties which are built facing south without some provision of this sort become unbearably hot during the heat of summer.

The floor should be made of material which will enable the sty to be thoroughly cleansed and disinfected from time to time. Concrete forms a sanitary and inexpensive floor, but it is cold, and if it is not possible to give a liberal supply of bedding it is a good practice to provide a movable wooden platform for the pigs to lie on. It is essential that this platform should not be

a fixture but such that it can be taken out of the sty to be cleansed and exposed to the sun, when it has become wet and dirty through absorbing moisture. It is decidedly prejudicial to the health of the pigs to have them lying on an evil-smelling and urine-soaked platform.

Bricks laid in concrete or in sand are usually regarded as forming a satisfactory floor. In comparison with concrete, bricks are rather warmer but less sanitary. Floors are fairly commonly made of rammed clay or chalk. These are fairly satisfactory but pigs are inclined to root them up, and they are not impervious to moisture. With regard to drainage, surface drainage is the more sanitary; and it is important to see that sufficient fall is provided.

Sties are often built with low walls, and with one small permanent opening leading into a little yard. These low walls are possibly favoured for economy in building, but low-walled sties are rarely really healthy. The atmosphere is usually close and stuffy, and they are uncomfortable both for the pig and for the man who has to clean them out, as he has to work in a crouching and unnatural position. Walls should be at least 6 ft. 6 in. high. Corrugated iron is fairly commonly used for roofing, but when used alone it is not satisfactory as it is readily affected by heat and cold, with the result that a sty with this type of roof is too hot in summer and too cold in winter. Corrugated iron along with straw thatch makes quite a good roof. Generally speaking, well constructed cattle boxes, especially those with exercise yards, ordinary covered yards, or partly covered yards such as are common in the north-east of Scotland, can be utilised to form suitable accommodation for pigs.

Fresh air, sunshine, and protection from extremes of heat and cold, together with sanitary floor conditions and facilities for exercise in the open air, go far to secure keen appetites, good digestion, the maintenance of sound health, and freedom from tuberculosis and other diseases.

Shelters for Open Air Pig-Keeping.—Since open air pig-keeping became widely practised, many different types of shelters have been devised. Where the system involves permanent enclosures, the shelters usually take the form of stoutly made wooden huts, of a more or less permanent character. In constructing these wooden huts, the general principles already outlined should be applied. When wood can be obtained cheaply, an economical and satisfactory roof can be made with wood and felt.

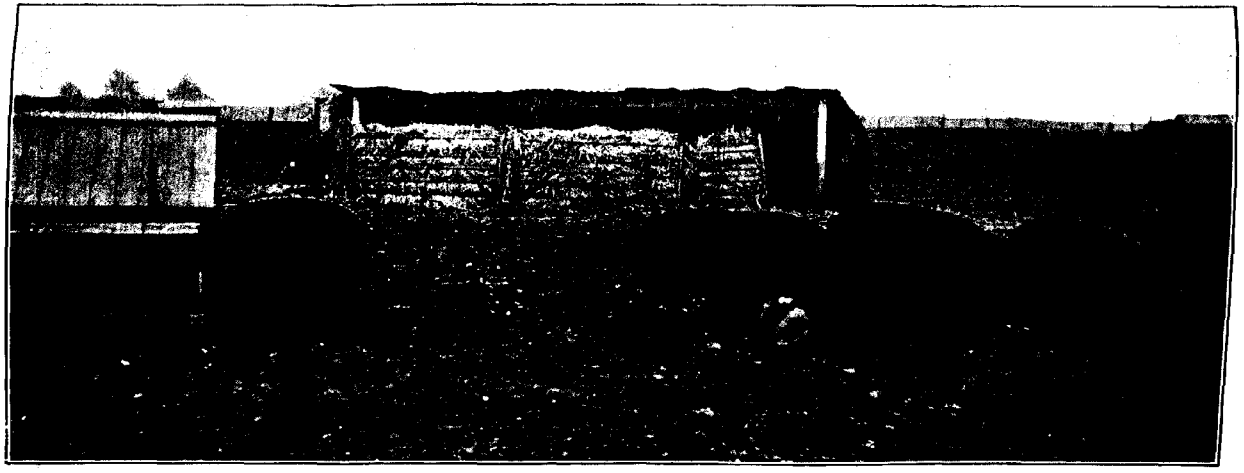

FIG. 1.—The first type of Pig Shelter used on the Northamptonshire Experimental Farm, Moulton.

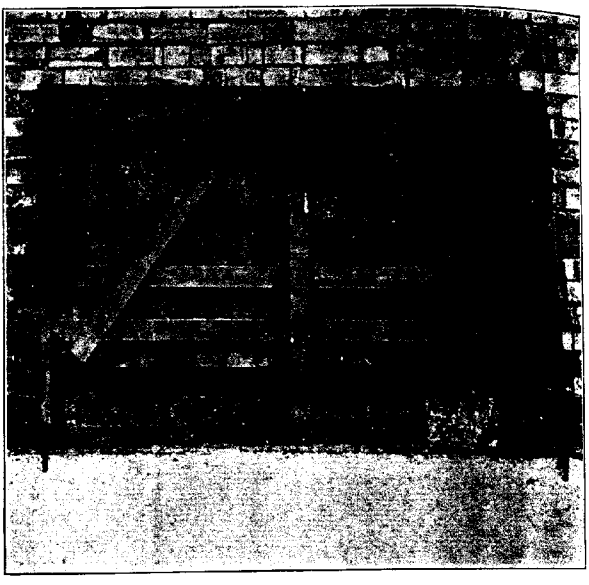

FIG. 2.—Boarded Hurdle used for making Shelters.

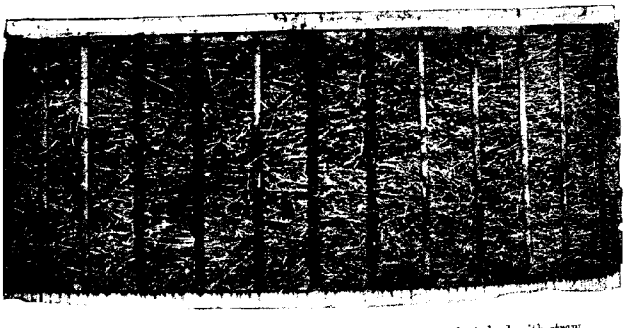

FIG. 3.—A Shelter Roof made of corrugated iron sheets thatched with straw on the under side.

For a system of management such as that practised on the Moulton Experimental Farm, movable shelters are much more useful than permanent and stationary huts. These movable shelters permit the practice of an elastic policy, whereby it is possible to run the pigs where they can be most profitably employed at any particular time. It may be to utilise arable land crops, to glean and clean the stubbles, or, if at any time arable land crops are not available, the shelters and the pigs can, with little expenditure of time and labour, be moved on to grass land. Our first type of shelter was made with thatched hurdles for the sides, back and front; and a roof consisting of corrugated iron thatched with straw underneath and fixed to two cross beams by means of bolts and nuts. Posts were used to support the roof in front, and at the back it was fixed to the tops of the hurdles.

Fig. 1 illustrates a rather roughly made shelter of this type. The gilts shown in the photograph lived in this shelter during the whole of the winter of 1922-23, on land where a crop of potatoes had been grown in the 1922 season. The potatoes had not been gleaned by hand and the gilts, fourteen in number, were penned on areas of about an acre at a time. They cleaned up the potatoes very effectively; practically none could be seen growing in the subsequent barley crop. On a ration of 4 lb. of dry meal per head per day together with the potatoes, they developed nice condition. This type of shelter, however, is not altogether satisfactory. The straw gets pulled out by the pigs and the hurdles require to be re-stuffed from time to time. Stuffed hurdles are not handy to move and they have now been abandoned in favour of wooden boarded hurdles of the kind shown in Fig. 2. The smaller size is used for the sides and back of the shelter and the higher size for the front. The smaller size is 6 ft. long, 3 ft. deep and the heads are 4 ft. high. The bigger size is 7 ft. long, 3 ft. 3 in. deep and the heads 4 ft. 6 in. high. Three-quarter-inch tongued boarding, $4\frac{1}{2}$ in. wide, is used.

A thatched roof is shown separately in Fig. 3, to illustrate the method of thatching on the underside. The sheets of corrugated iron employed to make the roof are 2 ft. wide, by 7 ft. long. Bolts of various lengths are used to fasten the iron sheets to the two cross beams. The thatch is supported by narrow wooden bars which are usually obtained from old or broken hurdles.

For heavy land conditions, a shelter like that shown in Fig. 4, made with wooden hurdles and a one-piece roof, can be recom-

mended; but for moderately dry and light land, a shelter on wheels or runners is a great convenience on account of the ease with which it can be moved. Wheels add considerably to the cost and it is doubtful whether they are necessary. Wooden runners or skids, preferably shod with iron, have been found satisfactory. A shelter of this type can be moved by yoking one horse to it. It provides a simple solution of the labour difficulty involved when frequent changes of position are required. In securing uniform grazing and uniform distribution of manure, particularly when pigs are folded on arable land, it is essential that the shelter should be moved frequently. A further advantage in its favour is that its position can be altered without difficulty whenever necessary in order to secure the most favourable exposure to afford protection from wind or rain, or in very hot weather to obtain the maximum shade from the sun.

The shelter shown in Fig. 5 has the following dimensions:—Length 8 ft., width 6 ft. 6 in., height 4 ft. at the front and 2 ft. 9 in. at the back. The floor is of 1-in. elm boards on two 6-in. by 2-in. oak skids. Sides, front and back are of $\frac{3}{4}$-in. tongued boarding; roof of $\frac{3}{4}$-in. square edge boarding covered with sanded felt; upright posts 3 in. by 3 in.; doorway 2 ft. wide. A hinged door which opens outwards and downwards forms a platform for the pigs to walk on when going out and in. A farrowing rail is provided when required.

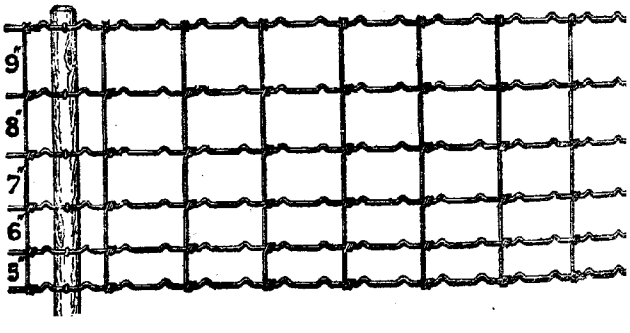

FIG. 6.—Light type of Fencing.

Fencing.—Several inquiries have been received recently as to the most economical form of fencing. At current prices we favour a make of wire which is offered at 5½d. per yard in 55-yard rolls. This fencing (*see* Fig. 6) is 35 in. high with verticals 12 in. apart. There are six horizontals, which are

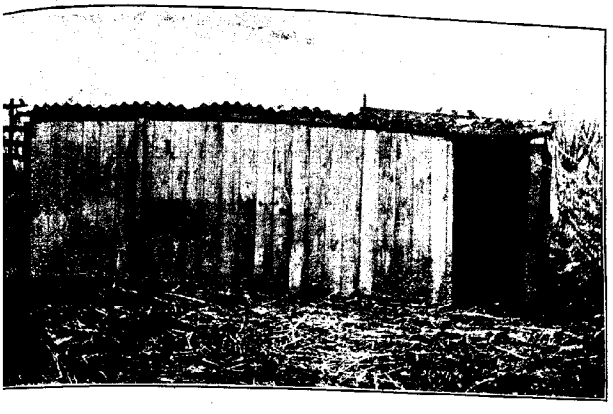

FIG. 4.—Second type of Shelter used on the Northamptonshire Experimental Farm. Boarded Hurdles replace Thatched Hurdles.

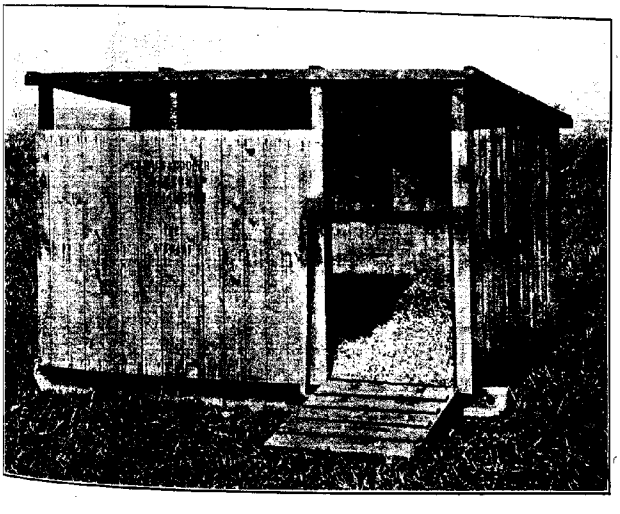

FIG. 5.—A Moveable Shelter on Runners in use on the Northamptonshire Experimental Farm.

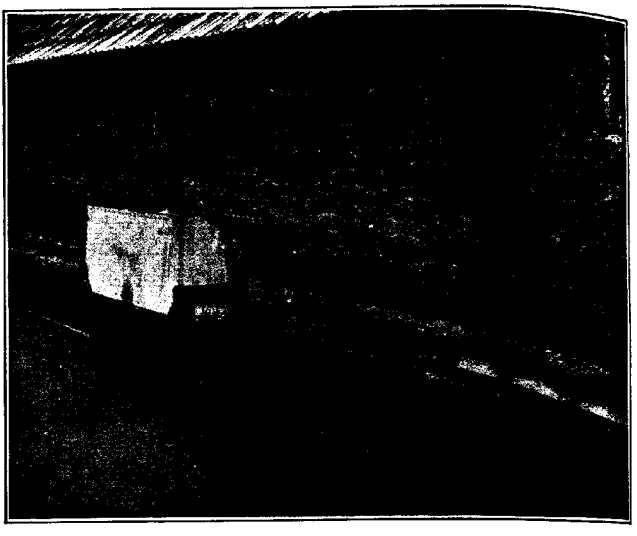

FIG. 8.—Feeding Trough, and Trolley on rails for conveying the food.

FIG. 9.—Weighing House and Loading Dock.

5 in apart at the bottom and 9 in. apart at the top; the intermediate horizontals being 6 in., 7 in., and 8 in. apart, widening from the bottom upwards.

A heavier type of wire with verticals 6 in. apart, and 8 horizontals 3 in. apart at the bottom widening to 6 in. apart at the top, is being offered at 8½d. per yard. This class of wire (Fig. 7) is considerably stronger, and the smaller mesh is an advantage for fencing in small pigs, but for most classes of pigs used to outdoor conditions, the cheaper type of wire is satisfactory, particularly for arable land fencing. A strand of barbed wire along the ground is sometimes recommended, but this should not be necessary except for very troublesome pigs. Both types of wire are sold in two weights; the lighter weight is found sufficiently strong.

Stakes are required at intervals of four yards. Home-made stakes 3 in. by 3 in. and 4 ft. 6 in. long, obtained from wood felled on the farm, are used on the Experimental Farm. The stakes are cut out with a small power-driven circular saw 24 in. in diameter, which was installed in 1922 at a cost of £15 and which has proved a very economical purchase. The power for driving the saw is provided by the engine which is also used to drive the grinding mill and root pulper. It is very important to get the wire stretched tight before fixing it to the stakes. A useful wire strainer for this purpose is sold by most agricultural implement dealers at a reasonable cost.

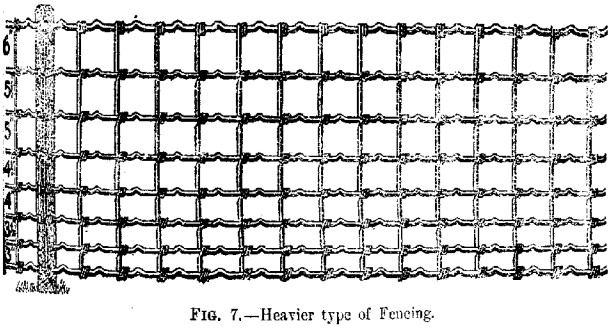

FIG. 7.—Heavier type of Fencing.

General.—In the general laying out of pig pens, the importance of making use of existing hard roads for carting feeding stuffs or water should be kept in view. The more convenient the pens are to the central feeding house, the less labour will

be required in feeding. If pens can be so arranged that a stream or other water supply is utilised so that pigs find their own drinking water, it will still further economise labour, especially where dry feeding is practised. Fig. 8 shows a feeding trough in a yard on Lord Bledisloe's Cross Farm, Lydney. The trolley on rails is used to convey the food from the feeding house to the troughs. The importance of having a weighbridge on the farm cannot be overestimated. An ordinary spring balance weighing up to 550 lb. and crate will be found very useful. Fig. 9 shows a combined loading dock and weighing house on Lord Bledisloe's farm.

In concluding this series of articles written at the request of the Ministry, I wish to express my grateful thanks to my colleagues, Mr. W. R. Seward and Miss J. W. Strang, for the assistance which they have given to me.

* * * * * *

DAIRY FARMING IN HOLLAND.

E. HATFIELD,
Ministry of Agriculture and Fisheries.

THE greater portion of Holland's milk is produced on small farms, *i.e.*, farms of from 5 to 30 acres. Farms of 60 acres are considered large, and are by no means common. Rents vary from about £3 10s. to £6 per acre, including tax. The breed of cattle kept is the Friesian, either black-and-white or red-and-white, the former predominating. The cost of dairy cows 2½ years old ranges from £28 to £33, and the average annual yield of a cow in full milk is about 1,000 gallons. Young cows with first calf give less than this quantity, but taking the figures given at one of the factories—which must be accepted as being approximate, at any rate as to the number of cows—the yearly average yield from the 3,000 cows producing milk for this factory is 800 gallons per cow.

The average fat content of the milk supplied to the factories is around 3·3 per cent., although in Friesland it is reported that many herds produce milk with a fat percentage of 3·75 per cent. or higher.

Some of the factories render good service to their members by taking frequent samples of the milk from each cow from which milk is supplied, and the information thus obtained, in

conjunction with the records kept of the quantity of milk given, forms a very useful guide to the farmer in weeding out unprofitable cows. The various Cattle-Herdbook Associations are responsible for carrying on propaganda work, as well as the supervision of milk recording, and for ensuring that animals entered in the herdbooks are not only bred for producing a high quantity and quality of milk, but are also symmetrical in form and fully developed in body. One very interesting activity of the Herdbook Associations, and the Association of Co-operative Dairy Factories in Friesland, is what is known as a "Sanitary Service" for cattle in Friesland. This Sanitary Service is always on the look out for sick animals, in order to remove them from the herd, and also endeavours to secure a healthy system of rearing young cattle. It pays special attention to tuberculosis and abortion, and regularly examines the herds of the members for the detection of these diseases. All animals causing danger to the herd are removed and killed.

A special pamphlet has been written in English on "The Original Breed of Friesian Cattle" and can be obtained from The Friesian Society of Agriculture, Landbouwhuis, 11, Willenaskade, Leeuwarden, Holland.

Dairy Factories.—The factory system is fast replacing the manufacture of dairy products in the farmhouse, and at present there are no fewer than 960 dairies in Holland, 686 of them being co-operative, and the remainder proprietary. The growth of the factory system has been encouraged (1) by the law that all milk shall be pasteurised before being sold for consumption, (2) owing to the large number of very small holders that exist, and (3) by the fact that a large proportion of produce is exported.

The co-operative factories seen by the writer were well designed and well equipped, particularly those of more recent construction.

When an association of farmers desires to establish a co-operative factory, the Land Bank is approached for a loan to cover the cost of construction and equipment, this amount being guaranteed by each and every member of the proposed factory. In this way membership does not involve direct capital outlay, but each member must guarantee to pay his share of liabilities, up to any amount, if that is necessary. He must also bind himself to deliver all the milk of his cows for handling at the factory, and in some cases he is liable to a fine of five guilders per 1,000 litres (8s. 4d. per 222 gallons) in respect of the quantity of milk he has supplied to the factory during the 4 years

immediately preceding, if his supply is withdrawn without the consent of the Directors.

The milk is usually bought and paid for on the butterfat basis. In a purely butter-making factory the price paid is 7½ to 8 cents per litre (6·75d. to 7·2d. per gallon) in winter, and 4½ cents per litre (4·05d. per gallon) in summer, and in addition the farmers receive their quota of separated milk and buttermilk free. In cases where milk is purchased by factories for disposal as liquid milk, the price paid is 11 cents per litre (9·9d. per gallon) in winter, and 7 cents per litre (6·3d. per gallon) in summer.

For separating, the milk is heated to a temperature of 30° C. (86° F.), the cream being further pasteurised to a temperature of 83° C. (181° F.), and then cooled to 13° C. (55° F.), before starter is added.

Many of the factories make cheese, as well as butter.

At one of the most up-to-date factories, where this system is in vogue, the milk is received twice daily. The receiving platform is open, and equipped with a weighing machine on each of three sides. From the weighing machines—which are of the dial type and Danish manufacture—the milk is run into a receiving tank, from which it is pumped over a water cooler, and afterwards run by gravitation into jacketted vats, where it is left for a given period—usually about 12 hours— in order to allow the cream to rise. The lower layer, of partially skimmed milk is run off and made into cheese, whilst the cream, or upper portion, is pasteurised, ripened, and made into butter.

The skim milk is made into Edam and Gouda cheeses, which are quickly made, the time taken between renneting the milk and putting the curd into moulds being from 2 to 2½ hours. When the curd has been in the moulds for from ¼ to ½ an hour, it is turned, then left for 2 hours more, and afterwards put under pressure for 3 hours. When taken from the press the cheeses are trimmed, and placed in brine for 3 or 4 days. The brine, which is contained in large cement brining tanks, is kept circulating and cool by being pumped over a water cooler. In some cases the cheeses are coloured and waxed at the factory, but usually this is done by the Marketing Association. At this factory the whey is pumped into large tanks at the top of the building from which it is run through a separator to abstract the butterfat. The whey cream thus obtained is pasteurised and made into butter. Whey separation does not appear to be the general practice in Holland.

There does not appear to be provision at the factories for sterilising the milk churns, probably because the whey and separated milk are usually returned in the cans used for bringing new milk to the factory.

The farmers utilise the separated milk and whey for calf rearing and pig feeding. The German type of pig is usually kept, although it was stated that it is not very popular with the slaughterers.

Combination of Co-operative Dairies.—The next step in the co-operative structure is the combination of a number of co-operative factories, either for the purchase of their requirements, or the disposal of their produce. At Leeuwarden were seen four distinct examples of the way in which various co-operative dairies in Friesland amalgamate for (1) retailing milk, (2) dealing with surplus milk, (3) manufacturing dairy requirements, and (4) marketing cheese, butter and cream.

(1) *The Co-operative Steam Dairy* at Leeuwarden deals with 3,000 gallons of milk per day, some of which is pasteurised and sold as liquid milk. The remainder is separated, a portion of the cream being sold and the rest made into butter. The separated milk has such a proportion of cream added to it as will make a 20 per cent. or 10 per cent. Edam cheese, in accordance with the market demands. Another product at this factory is buttermilk soup, made by boiling pearl barley in the buttermilk. This is put up for sale in sterilized, stoppered, glass bottles.

This dairy sells the bulk of its products retail in the town of Leeuwarden. The whey, and as much of the buttermilk as is not made into soup, are returned to the affiliated factories or sold to local pigfeeders.

It is interesting to note that at this factory all the cheese moulds are periodically sterilized with live steam in a special chamber.

The price paid to the affiliated farmers' factories for milk is 11 cents per litre (9·9d. per gallon), and the retail price is 15 cents per litre (13·5d. per gallon).

(2) *The Co-operative Milk Products Factory* at Leeuwarden is owned by 45 farmers' co-operative factories for the purpose of dealing with the surplus milk of these factories. The amount of milk dealt with is about 22,000,000 litres (nearly 5,000,000 gallons) per annum. The price paid for the milk varies with the current price of cheese, and any profits available at the end of

the year are distributed among the affiliated factories in proportion to the amount of milk supplied by them.

The milk is made into sweetened and unsweetened condensed and evaporated milks for sale in Holland, as well as for export. The evaporated milk is condensed to half bulk, and then homogenised before being put into hermetically sealed tins. All tin containers are made on the premises, the maximum output being 70,000 tins per day. All the boxes required for packages are also made up on the premises.

Each affiliated factory agrees to send at least one-tenth of its total supply to the condensery for a certain portion of the year.

(3) *The Co-operative Rennet and Dairy Requirements Factory* at Leeuwarden is owned by 70 farmers' co-operative factories. It manufactures rennet, paraffin wax, colouring, lime soap, and other dairy requisites for sale to the affiliated factories and others.

(4) *The Friesche Co-operative Zuivel-Export Vereeniging Leeuwarden—Nederland*, was established in 1898 for the purpose of selling the milk products of the farmers' co-operative creameries, which are members of the Export Association.

At its large warehouses in Leeuwarden, the Association provides storage accommodation for 1,500 tons of cheese and 40,000 casks of butter. All cheese and butter is sold subject to inspection by the Government and the Friesian Co-operative Creameries' Control Institutes. The cheese may be made from full milk and contain not less than 48 per cent. of butterfat, or halfmilk containing not less than 30 per cent. of butterfat.

The store rooms for cheese are all served by a cold air duct, so that the temperature can be regulated even in the hottest weather. The butter store is kept at a temperature of 5° to 8° C.

When cheeses are required for export to the tropics, they are tested and tried out by being placed in a room kept at a high temperature, before being coloured and waxed ready for dispatch. Cheese and butter are also prepared for export by being put up in sterilized tins, which are hermetically sealed after filling.

Cheshire and Edam cheeses are treated by being immersed in paraffin wax heated to a temperature of 120° C., to reduce the loss by evaporation.

Affiliated factories forward consignments of cheese or butter to the store each week, thus preventing congestion in their own stores. The Marketing and Exporting Society has the right to instruct the factories to manufacture any type of cheese that may be required to meet the market demands, for the time being.

The General Netherlands Dairy Association.—The majority of the co-operative dairies are members of this Association. Its objects are to improve the quality of the produce of the factories by means of weekly competitions, by holding courses for the dairy staffs, by yearly examinations to test the efficiency of aspirants for the positions of assistant manager, butter-maker, cheese-maker, engineer and milk inspector respectively, as well as by giving advice and assistance with the building and equipment of new factories. It also purchases such requirements as coal, oil, packing materials, milk testers, etc., for the joint account of the federated associations.

The association concerns itself with collecting detailed statistics of the administration and work of the associated factories, as well as with publishing a weekly paper for the general propaganda of co-operative dairy work.

Butter and Cheese Control Laboratories.—The various butter and cheese control stations do not receive any financial assistance from the Government, although their operations are always under the strict supervision of Government officials.

Butter control was established in 1901 and in order to guarantee the purity of Netherlands butter a Government mark has been introduced. This Government mark is only placed on the butter made in dairies which are under the strict supervision of one of the seven butter control stations. It not only guarantees purity but also that the butter does not contain more than 16 per cent. of moisture.

Cheese control was established in 1907, and, as with butter, a Government mark is issued for each of the 4 standards of quality of cheese produced, namely—

* Full-cream cheese containing not less than 45% butterfat.
Part " " " " " 40% "
" " " " " " 30% "
" " " " " " 23% "

The control mark for full cream cheese consists of a red transparent piece of casein with the Dutch coat-of-arms, and an inscription at the back in blue.

The control mark for cheese other than full cream, consists of a round, uncoloured, transparent piece of casein with the figures 40+, 30+, or 20+, according to grade, in a black hexagon with inscription. These marks are pressed into the cheese whilst in the moulds, thus becoming a portion of the rind, so that they cannot be removed without being broken.

* Full-cream cheese denotes cheese made from whole milk, and part-cream [illegible] is made from partially skimmed milk.

Even if the disc is taken off, the figures, which are printed on the under side, will remain on the cheese.

The marks for both butter and cheese have also a letter mark, and are numbered consecutively, by which means, with the help of control registers, it is always possible to trace the place and date of manufacture, in the event of a complaint being lodged.

For milk there is a definite fixed standard of 2·8 per cent. of butterfat, but no standard for solids other than fat.

The control stations are run by committees of management, the majority of the members of which must be non-producers. Members must also be of good reputation, not be concerned with the manufacture of margarine, nor be interested in the butter or cheese trade—presumably as traders or factors.

One of the outstanding features of this control system is the incentive it gives for the constant and careful steps taken to control the quality of the produce at each stage of its manufacture, and subsequent handling. The co-operative factories, the marketing associations, the dairy associations, and the control stations, all possess well equipped laboratories and qualified dairy chemists.

The co-operative system, as developed in Holland, tends towards specialization—the farmer in milk production, the factory in the production of the best quality of milk-products, and the marketing associations in finding the best markets, and providing the goods required by those markets.

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THE UTILISATION OF WASTE PRODUCTS IN AGRICULTURE.

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THE utilisation of industrial residues and waste products for agricultural purposes, as feeding stuffs or manures, and even for human food, was a subject that perforce attracted much attention during the late war both in allied countries and, especially, in Germany. Although many of the expedients adopted on both sides to eke out dwindling resources of feeding stuffs and manures were uneconomic, and therefore bound to disappear on the return of more normal conditions, some of the information gained was of permanent value even in time of peace. The whole subject has recently been exhaustively reviewed in a monograph by Prof. A.

Bruttini,* who has collected a large amount of valuable information, derived from allied and from German sources.

Waste products can in certain cases be utilised for manurial purposes, for cattle feeding, or finally for human food. From the agricultural point of view it is the first two of these methods which are of special interest.

Many more waste products can be used as manures than as foodstuffs, for, apart from products possessing no animal-feeding value, many which do possess such value also contain substances harmful to animals, rendering them unsuitable as feeding stuffs. On the other hand, there are few waste materials which do not contain plant food, available or potential, or constituents capable of exerting a beneficial effect on the physical properties of the soil, and even when they also contain bodies inimical to plant growth, such harmful bodies are often destroyed after incorporation with the soil.

The economic utilisation of waste products in agriculture is mainly determined by their bulkiness and water content in relation to the amount of nutrient elements and organic matter they contain. The cost of transport, or of drying down, may be so high as to render the product, as finally used, more expensive than any of the recognised artificial manures, when the comparison is made on the unit value of the fertilising elements. The utilisation of many waste products thus depends on whether they are produced in close proximity to agricultural land, so that freight charges can be eliminated or reduced to a minimum.

Sewage.—There can be no doubt that under the conditions of modern civilisation, by far the biggest source of waste, from the point of view of agriculture and food production, is that entailed in sewage.

In rural districts unprovided with main drainage, a large part of the excretory products of the population may find its way back, sooner or later, to the land, but in urban and industrial areas enormous amounts of most valuable fertilising material are lost well-nigh irretrievably in the sewage effluents which are discharged directly into, or find their way ultimately to the sea. Considering the question of nitrogen alone, an adult man excretes on the average 16 grammes of this element per day, the quantities for a woman and a child

* Ramassage et Utilisation des Déchets et Résidus, by Prof. Arturo Bruttini, published by the International Institute of Agriculture, Rome, 1922. To be obtained from the Ministry of Agriculture, 10, Whitehall Place, London, S.W. 1, price 20 Frs. An English Edition of this book under the title *Uses of Waste Materials*, has now been published by P. S. King & Son, price 12s. net.

being respectively 13 and 8 grammes. In the British Isles, with a population of over 45 million, of which roughly half are on main drainage systems, there are nearly 120,000 metric tons of nitrogen lost into the sea every year, equivalent to the nitrogen of 600,000 metric tons of sulphate of ammonia. Unfortunately, a large part of this nitrogen exists in sewage effluent as soluble compounds in a state of very high dilution. A small part of this nitrogen may be utilised on special sewage farms, but the greater part is inevitably lost. The use of straw filters for the recovery of this soluble nitrogen, which is discussed later (p. 916), presents too many practical difficulties to offer much hope of a general solution of the problem, and short of the discovery of a cheap chemical capable of precipitating nitric and ammoniacal nitrogen from very dilute solutions in an insoluble form—a very remote possibility from the chemical point of view—it appears as if this enormous loss of nitrogen into the sea is unavoidable.

A small, but in the aggregate, important proportion of the nitrogen in sewage is present in an insoluble form as sludge. The older processes of sewage purification give rise to a sludge, the solid matter of which contains only a very small percentage of nitrogen, so small as to render the sludge of little value as a manure. In recent years, however, a new method of purification has been developed, which results in a sludge known as "activated sewage sludge." This contains a much higher percentage of nitrogen and the other fertilising elements than the older sludges.

Trials have been carried out at Rothamsted* with activated sludge, made at the Harpenden sewage works, of the following composition:—

Composition of Dry Matter of Activated Sewage Sludge.

Type of Sludge	*Total Nitrogen %*	*Organic Matter*	*Phosphoric Acid* (P_2O_5)%	*Potash* (K_2O)%
Harpenden Activated 1.	... 4·93	62·05	2·86	0·28
„ „ 2.	... 5·94	73·30	3·00	0·43
„ Slate bed †	... 2·63	46·80	0·34	0·08

It will be seen that the activated sludges are markedly richer than the old type of slate bed sludge in all three essential fertilising constituents. Manurial trials with the activated sludges were carried out on hay, potatoes and barley. Generally speaking, the activated sludge gave good yields in

* E. H. Richards and G. C. Sawyer, *Journ. Soc. Chem. Ind.*, 1922, 41, 62, T.
† For comparison.

comparison with sulphate of ammonia or farmyard manure applied to give equal weights of nitrogen to the plots. Activated sludge thus possesses a high manurial value in marked contrast with the old type of sewage sludges tested on the Rothamsted farm in past years.

It has been calculated that from the sewage of all the towns of the British Isles with a population of 100,000 or over, 1,800,000 tons of sludge are produced per annum, so that if this were all of the activated type, a by no means negligible amount of an apparently valuable organic manure would be made available for agriculture. The activation process of sewage purification is, however, only carried out in a few centres in this country, and even there on little more than an experimental scale. Until the process has been put on a sounder economic basis, both as regards the cost of activation and the drying of the sludge, it does not offer much immediate promise of becoming a source of benefit to the farmer.

It was mentioned above that roughly only half the population of this country is served by main drainage, and that the waste products of the other half may ultimately find their way back to the land. From the point of view of the agricultural utilisation of these waste products, however, there are great possibilities of improvement. Practically the whole of the agriculture of China is founded on the use of night soil as manure, and a very elaborate organisation has existed in that country from time immemorial for the collection and agricultural use of human waste products. It is estimated that in China nearly 130,000,000 tons of such products are used every year, representing over 800,000 tons of nitrogen, 250,000 tons of phosphoric acid and 300,000 tons of potash. The manurial utilisation of human waste products finds a more limited, but still extensive application in certain European countries, notably in Flanders—hence the name of "Flemish manure"—and in certain parts of France and Italy.

Although there is little possibility of such extensive development in this country, the subject merits careful consideration in view of the growing scarcity of animal manure. So far from being unhygienic, as it might at first sight appear, the manurial utilisation of human waste products, properly organised, would in many cases make for a distinct improvement in the sanitary conditions and general health of many of our villages, in which the frequent occurrence of epidemics is without doubt partly attributable to unhygienic methods of

sewage disposal. It is difficult to devise methods of general applicability, but rural authorities and estate owners could render a great public service by devoting serious attention to the special condition of their own districts with a view to the introduction of methods of sewage disposal which would be hygienic and at the same time not agriculturally wasteful.

Town Refuse.—Another type of domestic residue of some agricultural value is that obtained in urban districts, consisting of the refuse collected by the municipal and urban authorities from road sweepings and house refuse. This material is of course of a very varied nature, and contains much of no manurial value, but many of the larger towns and cities now have installations for treating and sorting this refuse. The crushed and sifted material is of distinctly promising value as a manure. It is unnecessary to devote space to the subject in this article as it has recently been specially dealt with in this *Journal*.* Manurial trials of refuse in comparison with town stable manure are being carried out at Rothamsted this year.

Sea Products.—Turning next to natural organic products not of domestic origin, it is convenient first to consider those derived from the sea. As already pointed out, modern systems of sewage disposal result in the loss by discharge into the sea of enormous amounts of nitrogen, phosphorus, and potash. In the distant future the time will arrive when the present-day resources of those fertilising materials will be approaching exhaustion, and it is probable that when this is the case, the resources of the sea will have to be utilised. As far as the supply of nitrogen is concerned, the atmosphere is available as an alternative source, and without doubt, by the time that our supplies of combined nitrogen are exhausted, industrial processes for the fixation of atmospheric nitrogen will have been so far developed that they will be able to supply our needs. For potash and phosphates, however, the sea will probably then be the only alternative source. The potash and phosphates which find their way into the sea ultimately serve for the growth of the higher marine organisms, animal and vegetable, of which the most important representatives are fishes and seaweeds respectively.

Seaweed.—In the wet state seaweed is not very different in composition from farmyard manure, though it is somewhat poorer in phosphoric acid; its average percentage composition is: water,

* November, 1922, p. 685; December, 1922, p. 838; December, 1923, p. 870.

70.80; organic matter, 13.25; nitrogen, 0.3-0.5; potash (K_2O), 0.8-1.8; phosphoric acid (P_2O_5), 0.02-0.17. Manurial trials carried out in Scotland and Ireland show that wet seaweed is almost as good as dung.* Seaweed is extensively used as a manure in maritime districts both abroad and in this country.† In the coastal districts of Scotland and Ireland, and in the Channel and Scilly Islands, it is collected in large quantities and either applied directly to the land—with or without a preliminary fermentation—especially by potato growers; or it is worked up for its high content of potash and iodine either by lixiviation or by burning it and extracting the ash.

Thoroughly dried and powdered seaweed contains as much as 25 per cent. of muriate of potash, most of which can be readily extracted with water. When burnt, the dried material gives from 35-50 per cent. of ash with a potash content (K_2O) of 36-42 per cent.

In Norway, France, Italy, and Japan seaweed is similarly used. It is, however, on the Pacific coast of North America that seaweed, or "kelp," is most extensively used. There, several companies "harvest" the kelp on a commercial scale, and during the War the extraction of potash (and iodine) from kelp was greatly developed. The Bureau of Fertilisers has founded a special experimental station in California for the study of the utilisation of kelp.

Fish Residues, in the form of fish meal, or fish "guano," are too well known as a fertiliser to need more than cursory notice here. It is worth while, however, to note that by the use of fish manure some of the nitrogen and phosphorus lost into the sea as sewage is regained for the land.

Straw.—Before dealing with waste products of purely industrial origin, mention must be made of the utilisation of straw. During the War the increased amount of cereals grown in allied countries resulted in the accumulation of large quantities of straw for which no practical use was available. A process was worked at Rothamsted by Hutchinson and Richards whereby straw can be fermented and converted into so-called "Artificial Farmyard Manure." This product has given very good results in manurial field trials, and it appears to have great possibilities, especially in corn-growing districts, where straw is always plentiful and farmyard manure can only be

* See *Trans. Highland and Agric. Soc.*, 1898, p. 118; *Jour. Dept. Agr. & Techn. Instr. for Ireland*, Jan., 1914.

† See this *Journal*, Sept., 1910, Vol. 17, p. 458; and Leaflet No. 254.

obtained in sufficient amount by keeping beasts primarily for treading down the straw into manure. The process is now being developed on a commercial scale. It is unnecessary to deal with it in detail here as it has already been described in this *Journal* by the authors of the process.* Essentially the same process has been used for sewage purification,† and the conservation of the nitrogen of sewage. The effluent is allowed to flow slowly through a series of straw filters, and the fermentation of the straw can go on in the presence of the very low concentrations of nitrogen in the sewage; in actual practice 65 per cent. of the nitrogen was retained. The product after removal from the filter is allowed to go on fermenting for some time. The bulkiness of the straw, and the consequent large size of the installation (it is calculated that 2 lb. of straw are needed per person and per day) are such that the process would be inapplicable to large towns, but for small communities it has distinct possibilities.

Industrial Waste Products.—The various waste products of the slaughter house—dried blood, meat meal or "guano," greaves, tankage, etc.—are all well established manures, and it is unnecessary to discuss their manurial value here. Finally there are the waste products of industrial processes to be considered. Among the organic materials comprised in these residues the following may be mentioned.

Brewery and Distillery Residues.—Brewers' grains, if for any reason unsuitable for feeding, and spent hops, are of small direct manurial value, but if obtainable cheaply they can be composted into a manure of some value for its physical effects. Vinasse, the residue from distillation of spirits, is used for feeding purposes, but the vinasse of molasses is rich in potash, and is worked up commercially for the preparation of potash salts.

Tannery Residues.—Waste tan is liable to be harmful to plants if applied to the soil in a fresh condition owing to its content of tannin, and in any case it is of little direct manurial value. After composting for a year or more, however, it is a useful material for lightening the texture of the soil, and finds some application in horticulture for this purpose or for mulches and hot-beds. It is also used for mushroom culture. Hide parings and the sludge that settles out in the steeping vats, often contain appreciable amounts of nitrogen, and if obtainable

* August, 1921. Vol. 28, p. 398.

† E. H. Richards and M. G. Weekes, *Proc. Inst. Civil Eng.*, Engineering Conference, 1921.

cheaply are of distinct manurial value, though on the slow acting side. The sludge is rich in lime and therefore valuable for its physical effect and for sour soils.

Leather Waste, on the other hand, is of little or no value as a manure if derived from tanned hides, as it breaks down in the soil only with extreme slowness. It can be improved by suitable chemical treatment, though this is not carried out to any important extent on a commercial scale. In 1917 a committee of the British Association studied the question of the utilisation of old army boots and it was found that by dry distillation a yield of 23-25 per cent. of crude sulphate of ammonia could be obtained. Soft leather scraps are in a different category. They are quite a useful manure, and are used in some market gardening districts, *e.g.*, in Worcestershire.

Sugar Works Residues.—In view of the establishment of the beet sugar industry in this country, the value of the residues of this industry merits consideration. The tops from the beet, the extracted pulp, and the molasses are all useful feeding stuffs, but the first two can also be used directly as manures, while molasses were used during the War, after suitable treatment, as a constituent of compound manures.

Spent animal charcoal is rich in phosphoric acid and also contains 1.5 to 2 per cent. of nitrogen; it is a useful manure, and has long been used as such on the Continent, especially in the neighbourhood of sugar works.

The calcareous sludge obtained from the filter presses is mainly useful as a source of lime, of which it contains about 20 per cent., together with ½ to 1 per cent. of phosphoric acid. It is a good material for improving the condition of stiff or sour soils.

Oil Cakes.—Oil cakes unsuitable for feeding, such as those of castor oil beans, bitter almonds, belladonna, mustard, contain 4-7 per cent. of nitrogen, and appreciable amounts of phosphoric acid and potash. If applied directly to the soil, this should be done some time before sowing, otherwise seedlings may suffer from fungus attacks. Alternatively, they may be composted.

Wool and Silk Waste.—Wool waste or shoddy is a useful manure, containing about 5 per cent. of nitrogen. Satisfactory results have been obtained in experiments at Rothamsted.* Silk waste is fairly rich in nitrogen (8-10 per cent.) but is rather slow in its action.

Hair, Feathers, Hoof and Horn.—These are all very rich in nitrogen (12-17 per cent.) but exceedingly slow in action. They

* This *Journal*, March, 1918, p. 1087.

are only suitable for direct use in beds which are laid down for several years, as in vine houses; otherwise they need preliminary treatment to render their nitrogen more readily available.

Among inorganic residues of industrial processes, *flue dust* from blast furnaces was considerably exploited during the War as a source of potash, then so scarce.* Similarly, flue dust from cement works is fairly rich in potash. A sample recently examined at Rothamsted (from a Swedish source) contained nearly 20 per cent. of potash.

A recent development which may assume considerable importance for greenhouse work is the manuring of plants by carbonic acid gas obtained by purification of exhaust gases from furnaces, etc., or from special generators. This idea originated in Germany, and extraordinary results are claimed from experiments carried out in that country. The method is now being tried by some hot-house growers in this country.

In this short article it has not been possible to give more than a cursory account of the more important aspects of the use of waste products in agriculture, more particularly for manurial purposes. The reader desirous of studying the subject in more detail is referred to Professor Bruttini's monograph. It is to be hoped that the stimulus given during the War to the study of this subject will not be wholly lost in time of peace, and that more attention will be paid to the question of preventing the loss of the incalculably large amounts of manurial elements in waste products of various origins, which occurs at the present time.

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THE PREVENTION OF "BUNT" IN WHEAT.

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ON previous occasions we have published in this *Journal*† the results of experiments in the prevention of "bunt" in wheat. These experiments have shown that formalin,‡ used at the

* This *Journal*, February, 1915, p. 1053; August, 1917, p. 526.

† Vol. 27, p. 1013 (1921); vol. 29, p. 722 (1922).

‡ Formalin is the trade name for a 40 per cent. solution of the gas formaldehyde in water. Purchasers should obtain a guarantee that the formalin sold is of the above strength and should see that it is a clear solution free from any precipitate. Formalin needs to be kept in a tightly closed bottle, and only freshly prepared diluted solutions should be used, as the gas is volatile.

greatly diluted strength of 1 part of formalin to 480 parts of water (=1 pint formalin to 60 gal. water) and applied at the rate of 2 gal. of the diluted solution to the sack (of 4 bushels), entirely prevents "bunt," and, unlike the "pickling" method with "bluestone" (copper sulphate), does not appreciably affect the germination of the wheat. The formalin method is simple, negligible in cost, and the labour involved is not greater than that of the customary "pickling" process when "bluestone" is used. Objections have been raised against the formalin method of treatment on the ground that the volume of solution used wetted the grains so much that difficulty might be experienced in drilling the seed, although farmers who have actually employed the method find no difficulty in this connection. Laboratory experiments had shown that 2 gal. of solution to the sack was necessary to ensure the thorough wetting of the seed and was therefore recommended. It was realized, however, that a lower rate, if equally efficient, might be desirable; and the object of the experiments described below was to ascertain whether a smaller quantity of the formalin solution than 2 gal. to the sack would suffice. Experiments were therefore made during 1922-23 using the formalin solution at the rate of 2 gal., 1½ gal., 1 gal. and ½ gal., respectively, to the sack. The seed wheat used was artificially contaminated with the "bunt" fungus, a large quantity of whole "bunted" grains being crushed in a mortar, and the mass of liberated *spores* being then well mixed into the heap of seed corn—enough spore-material being added to coat each grain and to darken its tuft of hairs. On taking out a handful of the contaminated seed corn, the palm of the hand became darkened with the spores of "bunt." As the results given below demonstrate, this method of contamination was entirely adequate, the untreated plots giving as high a percentage of "bunted" ears as 78. The comparative value of the differing quantities of formalin solution was therefore severely tested in a satisfactory manner.

Description of the Experiments with Formalin.—About two pints of "bunted" grains (obtained from the previous year's experimental plots) were crushed with a pestle and mortar and well mixed up with 1½ bushels of Red Standard seed wheat. Ten separate gallons of this contaminated seed were measured out, and five of them labelled A1, B1, C1, D1 and E1, respectively; to each of the other five gallons 90 c.c. (equivalent approximately to 2 per cent. by volume) of whole "bunted" grains were added, and these were labelled A2, B2, C2, D2 and E2, respectively.

The ten lots of contaminated seed were treated as follows, the solution used being 1 part of formalin in 480 parts of water (i.e., at the rate of 1 pint formalin to 60 gallons of water):—

A1 and A2 each received ½ pint solution, = 2 gal. per 4 bush.
B1 „ B2 „ „ ⅜ „ „ = 1½ „ „
C1 „ C2 „ „ ¼ „ „ = 1 „ „
D1 „ D2 „ „ ⅛ „ „ = ½ „ „
E1 „ E2 controls (untreated).

The method of treatment adopted was as follows: each gallon of seed wheat was spread out on a slate slab, then sprinkled with the allotted volume of the solution and shovelled into a heap; the seed was then again spread out and shovelled up twice; when the heap was thus made a third time the wetting treatment was considered complete. Each lot was then covered with a sheet of cloth moistened with the diluted formalin solution and left for four hours; at the end of that time the seed was spread out to dry in a layer about 1 inch deep.

The seed was sown* on the respective plots on 21st November, 1922, the day following treatment, the rate of seeding being about 3½ bushels to the acre. In order to reduce the chances of any re-contamination of the treated seed the plots were sown in the following order:—A1, B1, C1, D1 (at this stage the hands of the person sowing the seed were washed with the diluted formalin solution), A2, B2, C2, D2, E1, E2; the plots were then raked over in the same order.

Samples of the treated and untreated seed were sent to the Official Seed Testing Station on the day the plots were sown. The report received gave the percentage of germinating seed as follows:—

Volume of solution used to sack (4 bushels) of seed.		Sample.		Germination. Per cent.
2 gal.	...	A1	...	97
		A2	...	97
1½ gal.	...	B1	...	97
		B2	...	97
1 gal.	...	C1	...	96
		C2	...	96
½ gal.	...	D1	...	98
		D2	...	97
Untreated	...	E1	...	96
		E2	...	98

The uniformity of the results shows that the treatment with the diluted formalin solution, even when used at the rate of 2 gal. per sack, does not adversely affect germination in laboratory tests.

* As on previous occasions, Mr. P. Oglesby kindly sowed the plots by hand, and we desire to express our thanks for his assistance.

The relative positions of the ten plots are shown in the plan given in Fig. 1. A very good "plant" was obtained on all the plots. As the crops approached maturity, there was a striking contrast in the general appearance of the plots A1 and A2 and the control plots E1, E2, the plants of the former being taller and of a more healthy colour than those of the latter, which were obviously seriously affected in growth by the great prevalence of "bunt." In August, 1923, the crops were cut and made into sheaves in the usual way. Later, the sheaves were untied and a handful was taken from each so as to make one sheaf from each plot containing samples from various parts of the plot. The ten sheaves (*i.e.*, one from each plot) obtained in this way were carried to the laboratory; 1,000 ears (in ten lots of 100 each) were cut at random from each sheaf and the number of "bunted" ears present in each lot was ascertained.

The following Table gives the results obtained:—

Table showing the Number of "bunted" ears per 1,000.

Lots of 100 each.	A1. 2 gal.	B1. 1½ gal.	C1. 1 gal.	D1. ½ gal.	E1. Control (untreated).
1	1	3	19	65	81
2	1	0	25	80	89
3	0	1	20	78	78
4	0	0	9	61	68
5	0	1	11	79	71
6	0	0	9	73	88
7	0	1	20	78	78
8	0	0	23	62	77
9	0	0	19	39	80
10	0	5	13	54	76
1,000	2	11	168	669	786

Lots of 100 each.	A2	B2	C2.	D2.	E2.
1	0	2	37	77	82
2	1	0	29	57	79
3	1	4	24	60	88
4	0	0	29	80	76
5	0	2	39	79	85
6	1	4	16	74	64
7	0	0	26	64	76
8	0	0	13	55	75
9	0	1	20	66	82
10	1	1	35	54	76
1,000	4	14	268	666	783

It will be seen that the plots, the seed for which had received the same treatment (A1, A2; B1, B2, etc.), agree very closely

as regards the numbers of "bunted" ears, with the exception of C1 and C2. On the whole, however, it appears that the presence of the 2 per cent. of "bunted" grains added to the seed did not materially affect the result of the treatments, and the pairs of plots may therefore be considered as duplicates in estimating the percentage of "bunt," as given in the following Table:—

Plots.	*Rate at which the formalin solution was used.*	*Average of "bunted" ears, per cent.*
A1, A2 ...	2 gal. per sack (4 bush.) ...	0·30
B1, B2 ...	1½ „ „ „ „ ...	1·25
C1, C2 ...	1 „ „ „ „ ...	21·80
D1, D2 ...	½ „ „ „ „ ...	66·75
E1, E2 ...	untreated (control)	78·45

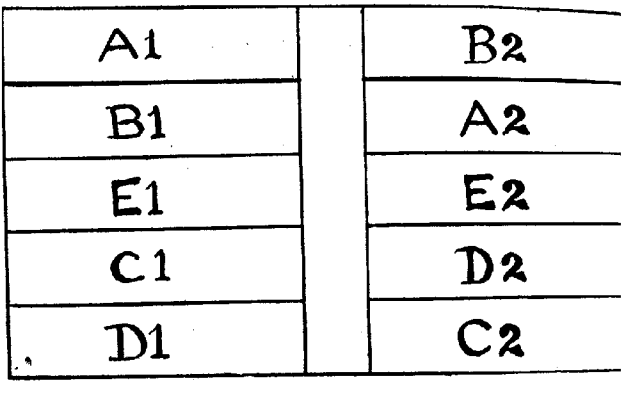

FIG. 1.—Showing position of the Plots.

It is clearly shown by the above figures that the amount of liquid required to disinfect properly each grain in a sack (4 bush.) of wheat, by the method adopted and described above, is 2 gal., the amount mentioned in our previous communications. Using 1½ gal. to the sack a very fair control of "bunt" is obtained, but used at the rate of 1 gal. to the sack the amount of liquid is clearly insufficient to disinfect properly each grain, with the result that over 21 per cent. of ears may become "bunted." It is reasonable to suppose from the figures obtained that the fungicidal action of the formalin solution is dependent upon the dissolved formaldehyde gas being brought by the water into close contact with the fungus *spores*.

Incidentally, the facts obtained suggest that where the "traditional" method of "pickling" wheat with copper sulphate

solution has been used by the farmer, in which only 1 gal. of the solution has been used to the sack (4 bush.), the results have been the escape of a large percentage of the grains from (1) disinfection of the "bunt" spores, and (2) death or injury to germination-capacity from the injurious effects of the copper sulphate solution on the grains.

Formalin and Copper Sulphate Compared.—The following field experiment, carried out on the College Farm at Wye, where formalin solution and copper sulphate solution were used, may be mentioned here.

The seed wheat (variety Yeoman) was treated on 9th November, 1922, some with formalin and some with copper sulphate, for direct comparison as to the effect on germination under field conditions. Three sacks of seed were dressed with formalin, diluted at the rate of 1 pint to 60 gal. of water, using 2 gal. per sack, and three sacks of the seed were dressed with copper sulphate dissolved at the rate of 1 lb. to 1 gal. of water, using 1 gal. of the solution to the sack.*

The seed was spread out on a floor, sprinkled with the solution and then shovelled into a heap; it was spread out and again shovelled up twice; when spread out and made into a heap the third time the mixing was considered to be complete. In the case of the formalin-treated seed the heap was then covered with sacks (which had been soaked in the formalin solution), left for 4 hours and then spread out to dry. The seed treated with the copper sulphate solution was, on the other hand, spread out at once to dry. Owing to adverse weather conditions the seed was not sown until four days later (13th November). The field was divided into four plots; two were sown with the formalin-treated seed, the other two with the copper-sulphate-treated seed. The rate of seeding was 3½ bushels to the acre. On the day of sowing samples were sent to the Official Seed Testing Station; the following report on the germination was received, the figures giving the percentage of germinated seeds.†

* This is the "pickling" method in common use in this country.

† Mr. C. B. Saunders, of the Official Seed Testing Station, commented on the results as follows:—"Your numbers 1 and 2, *i.e.*, the untreated and the formalin-treated, can be considered to have the same final germination, since the No. 2 might have reached 99 per cent. if we had left it on two days longer. It had germinated 97 per cent. on the fifth day, and we then discontinued the test. No. 1 did not reach 99 per cent. till the seventh day. This was in part due to the fact that one of the pots got rather dry, but apart from this I do not think it was as quick off the mark as your No. 2. The behaviour of No. 3 was quite different. It averaged 63 per cent. in five days, 73 per cent. in seven days, and went on germinating slowly till the eighteenth day, when we discontinued the test. It is possible that it might have done one or two per cent. more. We always find that copper sulphate retards germination."

	5 days.	7 days	11 days.	15 days.	18 days.
No. 1. Untreated	88	99	—	—	—
No. 2. Formalin-treated ...	97	—	—	—	—
No. 3. Copper-sulphate-treated	63	76	81	87	90

Some of the seed was kept until 30th November (three weeks after treatment) when samples were again sent to the Seed Testing Station.

The report showed the germination to be as follows:—

	5 days.	6 days.	7 days.	10 days.	12 days.	14 days.
No. 1 ...	96	98	—	—	—	—
No. 2 ...	97	—	—	—	—	—
No. 3 ...	67	—	77	84	87	92

On 14th December the field was examined; the plants from the formalin-treated seed were about 1½ in. high and it was estimated that, in appearance, they were 3 or 4 days ahead in growth compared with those from the copper-sulphate-treated seed. This difference in growth was maintained for some weeks, but ultimately the plots were indistinguishable as regards growth. Equal portions of the differently treated plots were harvested and thrashed separately; but no appreciable difference in yield was found.

The points of interest in the above field experiment are the delayed germination of the seed treated by "pickling" with copper sulphate, and the corresponding retardation of the appearance of the young plants above ground, thus lengthening the critical period when the seed is liable to attack by birds and other enemies. In this particular case the copper sulphate delayed germination and killed from 6 to 9 per cent. of the seeds. Cases have come to our notice* where the damage caused by the copper sulphate treatment has been considerably greater than this, 40 per cent. of the seed having been killed; and these facts suggest that high rates of seeding, to compensate for this damage, may have become customary.

Summary.—The following method of treatment is a certain preventive against "bunt" in wheat, and does not injure the germination of the seed, so that no increase in the proper rate of seeding is necessary:—

(1) The seed in a heap is sprinkled with diluted formalin solution (1 pint formalin in 60 gal. water = 1 fluid oz. to 3 gal. water). *Two gallons of the solution must be used to every sack (4 bushels) of wheat.* The seed is shovelled over and over until all the grains are wetted; the solution must not be allowed to form pools under the heap in which the grains might soak.

* See this *Journal*, Vol. XXVII, Feb., 1921, p. 1016.

(2) The heap of wetted seeds is covered over *for four hours*, not longer, with sacks which have been soaked in the diluted solution; the sacks should be uniformly wet but not dripping.

(3) The heap is then spread out to dry in a thin layer on a clean floor. If the floor has previously been used for untreated wheat it should be wetted all over with the diluted formalin solution and allowed to dry before the treated seed is spread on it.

(4) Precaution must be taken *to prevent the re-contamination* of the treated seed, *e.g.*, sacks which have held untreated contaminated wheat must not be used for the treated seed unless they have been soaked in the diluted formalin solution or boiled in water.

(5) The treated seed when dry should be sown *as soon as possible*.

The above method is as easy to use as the old "pickling" method with bluestone, it is also cheaper.*

At the present time (at any rate in the south of England) something like 50 per cent. of the samples of English wheat on the market are contaminated with "bunt." A certain, simple and safe remedy against "bunt" is now available in the diluted formalin treatment. When all farmers use it, English wheat will be clean.

* * * * * *

THE COMMON CAUSE OF FAILURE OF SPRING OATS—FRIT FLY.

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MANY farmers will remember the year 1922 as a particularly bad season for spring oats. April of that year was very cold and, as a consequence, oats made very little growth by the beginning of May.

Previous observations have shown that spring oats which have not made good growth before the first week in May usually suffer badly from attacks of the frit fly maggot. This occurred in 1922, when, as a result of frit fly attack, the average yield per acre in the eastern counties was probably well under four quarters. In addition many fields were ploughed up, and some fields which were undersown were cut for hay. The bushel weight was also very low owing to the attack of the second brood of maggots. One sample of oats from Norfolk examined by the writer contained nearly 60 per cent. of empty "seeds," the grain (or kernel) having been eaten by the frit fly maggot. This sample weighed under 24 lb. per bushel.

* The cost of material for treating a sack of wheat, with formalin at 2s. 6d. a pint, is 1d.

The oats on the University Farm sown on 16th and 17th March on strong soil in good condition gave the following results :—

Oat Variety Trials, 1922.

Variety.	*Strength of Straw.*	*Sacks Head at 168 lb.*	*Sacks Tail at 168 lb.*	*Total Grain Sacks.*	*Total Straw cwt.*	*Bushel weight, lb.*
Supreme ...	Short, moderate	8.8	0.92	9.7	23.1	31
Yielder ...	Poor	10.0	1.37	11.4	33.4	30
Bountiful ...	Good	7.35	1.11	8.5	34.2	31
New Abundance	Poor	9.93	1.47	11.4	35.2	30
Victory. ...	Good	8.8	1.60	10.4	36.0	33
Castleton Potato	Good	5.7	2.1	7.8	42.1	31
Black Tartarian	Good	5.3	2.2	7.5	31.6	28

This indicates that both poor tillerers like Black Tartarian, and extremely good tillerers like Castleton Potato, may suffer severely from attacks of the frit fly maggots.

Experiment on Dates of Sowings.—In 1923 an experiment was arranged to demonstrate that the date of sowing plays an extremely important part in determining the yield of spring oats. On a gravel field on the University Farm, plots measuring about one-twentieth of an acre were marked off. These received superphosphate 3 cwt. per acre, kainit 2 cwt. per acre, and the day before sowing each plot received sulphate of ammonia at the rate of $1\frac{1}{4}$ cwt. per acre.

The variety used was New Abundance, the seed having been grown on the University Farm the previous year. The seed was sown by hand in furrows about a foot apart, drawn out with a hoe, and the soil then raked level.

Plot 1 sown 1st February ; soil in good condition. 3 bushels per acre. Plants showing through 23rd February.

Plot 2 sown 20th February. (Too wet for sowing on the date arranged, 15th February.) Soil was rather wet for sowing on 20th February. 3 bushels per acre. Plants showing through 18th March.

Plot 3 sown 1st March on a good tilth. 3 bushels per acre. Plants showing through 24th March.

Plot 4 sown 15th March on a good tilth. 3 bushels per acre. Plants showing through 3rd April.

Plot 5 sown 23rd March on a good tilth. 4 bushels per acre. Plants showing through 7th April.

Plot 6 (Half plot). Sown 31st March on a good tilth. 4 bushels per acre. Plants showing through 12th April.

Plot 7 (Half plot). Sown 14th April on a good tilth. 4 bushels per acre. Plants showing through 29th April.

Results.—As the season advanced it was obvious that the yields of the plots would show great differences. An examina-

tion of the plots on 12th May showed that the first three were almost free from frit fly eggs, whereas eggs were found on every plant examined in Plot 7. On the other plots the number of eggs were fewer as the age of the plants increased. A careful examination of the plots was made on 28th May to determine the extent of the frit damage.

The earliest Plots (1, 2 and 3) showed only a very small percentage of attacked shoots, and most of these were damaged by wireworms or caterpillars. These plots showed very few late tillers.

Plot 4 showed a moderate attack, about one-third of the shoots being attacked.

Plot 5 showed a larger percentage of attack than Plot 4, but owing to the extra seeding (4 bushels per acre instead of 3 bushels) the number of healthy shoots was very similar.

On Plot 6 every plant was attacked, but a few healthy shoots were present on many of the plants. The number of ears was about 30 per cent. of those on Plot 1.

On Plot 7 every plant was badly attacked, and only a small percentage of healthy shoots remained. Most of the plants were badly stunted. The number of ears was about 10 per cent. of those on Plot 1.

The following table shows the yield of straw and grain:—

	Date of Sowing.	*Yield per acre in cwt.*	
		Grain.	*Straw.*
Seeded at 3 *bushels per acre.*			
Plot 1	February 1st	16.0	42.7
,, 2	,, 20th	14.9	31.0
,, 3	March 1st	15.2	29.3
,, 4	,, 15th	10.7	25.1
Seeded at 4 *bushels per acre.*			
Plot 5	March 23rd	9.9	25.3
,, 6	,, 31st	6.2	18.1
,, 7	April 14th	2.0	8.8

These figures indicate that the date of sowing has a great effect on the yield of spring oats. The oats sown on 1st March, or earlier, gave a good yield for the type of land (gravel) on which they were grown; those sown later in March gave rather a poor yield, while those sown at the end of March and in April gave extremely unprofitable yields. It should also be noted that the yield of straw gets less as the date of sowing gets later. The plot sown on 1st February gave a particularly good yield of straw, whilst the yield of the plot sown last was extremely low. A slightly later sowing on a headland near by gave even poorer results.

The differences in yield due to date of sowing will vary with the season, and also according to the type of land, but on all soils, even the very best, in any year there is usually a big

difference between early-sown and late-sown spring oats. On many farms it is extremely difficult to get a tilth early in the season—in February and early March. In cases like these when spring oats cannot be sown early, it is probably more profitable to grow very few spring oats and to get these in at the first opportunity; but for the later sowings, to substitute some other crop, such as barley, which is not likely to suffer much from an attack of frit fly. Many farmers know that late-sown spring oats in the south of England are not an economic proposition, but there are still a large number who do not realise that indirectly the date of sowing of spring oats is one of the most important factors in determining the yield. Winter oats, when they are a good plant in April, do not suffer much from damage by frit fly except in very abnormal seasons. Like wheat, however, they may suffer badly from frit fly attack in February and March if they are sown after a ley containing grasses ploughed up after harvest. Acknowledgment is made to Mr. S. G. Jary for his assistance in making the above observations.

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DODDER AND ITS REMOVAL FROM CLOVER SEED.

C. B. SAUNDERS.

IN this *Journal* for April, 1923, appeared an article, based on an inquiry made by the Ministry, on the "Prevalence of Dodder in Great Britain." The result of the inquiry, which dealt mainly with evidence from the field, showed that there was no apparent increase of dodder in this country. No distinction, however, was made between the different forms of dodder, and the present note, based on the records of the Official Seed Testing Station, is put forward in partial amplification of that article.

The Station records have been examined in so far as they relate to the occurrence of dodder in samples of red clover seed described as "English." The percentage of such samples found to contain dodder in the years 1917-18 to 1922-23 was respectively as follows:—

1917-18	...	24·0	1920-21	...	4·4
1918-19	...	12·1	1921-22	...	10·2
1919-20	...	3·4	1922-23	...	17·6

As might be expected, considerable fluctuation is shown, the presence of the seeds of dodder in commercial samples depending largely on the occurrence of climatic conditions favourable for the ripening of the seed.

The dodder found in red clover samples may for practical purposes be referred to two types—the small seeded form and the large seeded form. The first mentioned is the so-called "English Dodder" (*Cuscuta trifolii*, Bab.) which is indigenous and, under normal conditions, can ripen seed over the greater part of England south of a line from Hull to Liverpool. The term "large seeded dodder" is used to describe the non-indigenous species which occur generally in red clover of European and Chilian origin. These large seeded dodders include two or three closely allied species whose seeds are not easily distinguished from one another, and regarding whose nomenclature there is some difference of opinion. For the present purpose it will be convenient to describe them generally as forms of *Cuscuta racemosa*, Mart. The impression has been held in the past in certain quarters that the forms of *Cuscuta racemosa* do not ripen seed in this country or, at the most, only in exceptional circumstances. The fairly frequent occurrence of *Cuscuta racemosa* in samples sent to the Official Seed Testing Station as English-grown red clover has caused some doubt to be cast on the accuracy of this theory, and one practical object of this note is to draw attention to a fact which it is suggested is of economic importance.

The records of the Official Seed Testing Station show that in the last four years the percentage of samples described as English red clover which contained the large seeded dodder was 1.2, 2.2, 2.3, and 10.0 respectively. Figures for earlier years are not available. The occurrence of individual cases is easily explained by the fact that samples consisting wholly or in part of foreign seed are from time to time sent to the Station misdescribed as "English." There is no evidence that misdescription of this nature is increasing; in fact the reverse is almost certainly the case, since seed legislation has resulted in greater care and accuracy.

A critical study of the records relating to the 36 samples of English red clover in which large seeded dodder was found at the Official Seed Testing Station during the past season suggests that, though some samples are almost certainly misdescribed, the majority are from bulks once-grown in England from foreign seed containing the dodder. (This practice of applying the description "English Red Clover" to once-grown foreign seed is a matter which demands consideration.)

It is suggested therefore that there is evidence that the forms of *Cuscuta racemosa* can produce seed in this country, and that

the figures given above hint at the possibility of the plant gradually acclimatising itself to English conditions by the automatic selection of hardier and early ripening strains. Further, it seems not improbable that, if due attention is not paid to the matter, this pest may become as troublesome in England as it is in some continental countries.

In view of this possibility it is of interest to note that a new process has recently been discovered by which the removal of the large seeded dodder from clover seed is easily effected. The small seeded dodder is only about 0.8 mm. in diameter and can therefore be comparatively easily screened out of red clover, without loss of good seed, by the use of a sieve having holes of 1 mm. diameter—a mesh almost equivalent to a number $5\frac{1}{2}$ sieve. This separation therefore presents no difficulties to the seed cleaner.

On the other hand, *Cuscuta racemosa* is very similar in size to red clover, and consequently its removal has in the past been a matter of considerable difficulty even though the cleaner was prepared to face a considerable wastage of good seed, amounting sometimes in the case of Chilian seed to as much as 25 per cent. of the bulk. Such cleaning is laborious and expensive, and materially increases the price of "Dodder-free" seed.

It is worth while therefore to give a brief outline of the process referred to above, which will enable the cleaner to remove *Cuscuta racemosa* as easily and economically as he now removes *Cuscuta Trifolii* by the sieve method. The method, like that of some other cleaning machines, is based on the fact that the coat of a dodder seed is somewhat rougher and less polished than that of a clover seed. Advantage is taken of this in a novel manner. The seed is mixed with a magnetic powder, and more of this adheres to the rough coats of the dodder seeds than to the smooth coats of the clover seeds. The seed is then passed under a magnet which draws out the seeds bearing sufficient of the powder to be magnetically attracted. By this means not only can an absolute elimination of dodder be made, but there are also removed broken seeds whose rough surfaces hold the powder and rough-coated weed seeds such as Cut-leaved Cranesbill. The clover seed is then put through a polisher to remove adhering powder.

The first commercial machine working on the principle outlined above has been in use for six months, and has given remarkably good results, a single treatment removing every seed of dodder from a bulk of Chilian red clover. Apart from

its efficiency for removing dodder the importance of the process lies in the very small wastage. The machine has dealt with over 50 tons of seed, and the total cleanings are not much more than half a ton, so that it follows that the amount of good seed removed is negligible.

It is not claimed that the process results in a product free from impurity, but that its importance lies mainly in the fact that it provides a means of removing large seeded dodder from red clover, or in fact any dodder from any clover, with very little waste.

In conclusion, the present position regarding dodder in England can be summarised briefly:—

1. Small seeded dodder (*Cuscuta trifolii*) is probably on the decrease owing to greater attention paid to cleaning. This seed can be easily removed from red clover by screening.
2. Large seeded dodder (forms of *Cuscuta racemosa*) appears to be increasing, and may possibly be gradually acclimatising itself. It cannot be easily removed from red clover by screening, but a new process of magnetic separation seems to offer very great promise of supplying a simple and economic means of overcoming this difficulty.

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COUNCIL OF AGRICULTURE FOR ENGLAND.

THE Eleventh Meeting of the Council of Agriculture for England was held on Thursday, 13th December, 1923, at the Middlesex Guildhall, Westminster. The chair was taken by Sir Douglas Newton. K.B.E., M.P.

Appointments to Agricultural Advisory Committee for England and Wales.—A meeting of the members of the Council representing County and Borough Agricultural Committees was held before the meeting of the full Council, for the purpose of electing two members to serve on the Agricultural Advisory Committee to fill the vacancies caused by the resignations of Lords Aylwin and Bledisloe. It was decided that in the event of more than two candidates being suggested for the vacancies a ballot should be taken, and the first two names in the order of the voting should be declared elected. The names of Lord Aylwin, Lord Bledisloe, and Mr. Harry German, were proposed for the election, the first two on the assumption that they would be willing to be re-elected, having in view the circumstances under which they tendered their resignations. As a result of the ballot Lord Aylwin and Lord Bledisloe were re-appointed.

Meeting of full Council.—The Minister of Agriculture said with regard to the item on the Agenda which indicated that he would make a statement, that there was really no statement which he could make. The Government had placed a policy before the country in which Agriculture was largely concerned, and which they hoped would be very much to the benefit of the industry. The country had decided against it, and, therefore, he did not think he could usefully say anything at the moment.

The Council's Use and Functions.—Lord Clinton moved:—

> "That in order that this Council may be enabled to carry out the duties for which it was appointed, it is essential that opportunities should be given for the discussion of changes in Agricultural Policy before the Government is committed to them."

In his speech he referred also to the ineffectiveness of the Council as illustrated by the Agenda paper for the Meeting. He said that the Council was a thoroughly representative body, but that it had failed in its work. The causes were, he thought, several; it was largely due to its somewhat too close official connection with the Ministry of Agriculture. The Council also met once in 6 months, and it was absolutely impossible to carry on any work effectively with only two meetings per annum. To be effective the Council required to have an Executive or other Committee. He would like to see a Committee of the Council now appointed to inquire in what way the procedure could be altered so as to make its work effective for the industry which the Members presume to represent. *Lord Selborne*, in seconding the motion, said that in his opinion those who suggested that the Council should be abolished were making a great mistake. If the Council were compared with other agricultural bodies, it would be seen that it had advantages which none of them possessed. It represented owners,

farmers and labourers, education and research, and minor agricultural industries, as well as being extraordinarily representative in a geographical sense by reason of its County and Borough Agricultural Committee members. He thought it was partly the fault of the members of the Council themselves that the Council had been of such little use, and partly the fault of the Ministry of Agriculture. It was quite true that whatever Ministry was in office, from whatever party it was drawn, the Agricultural Policy adopted by that Ministry would eventually be the policy of the Ministry of Agriculture, for which it would have to be responsible. Instancing the action taken with regard to the importation of breeding stock from the Dominions, he did not question the right of the Ministry or of the Government to adopt that policy if, on the whole, it was thought to be a sound policy, but he did object to the reasons given. The Minister of Agriculture had said that the Council had unanimously given him certain advice, but that he had put that advice aside and had accepted advice given him by the Agricultural Committee of the House of Commons, from what, he understood was the advice of the Royal Agricultural Society and the Stock Breeding Societies. He did not dispute the right of the Minister to set aside the advice of the Council, but he did dispute the right to put another body as a rival authority to the Council.

The Minister of Agriculture said that the Council had been set up by Statute to assist the Ministry in the execution of its powers and duties. It was laid down in the Act that the Council should meet at least twice a year for the purpose of discussing matters of public interest relating to agriculture or other rural industries, and such meetings were to be held in public. The Minister was not a member of the Council, he came only by invitation, and had no power to initiate discussion. The whole of the proceedings were in the hands of the Council itself. At the initial meeting of the Council, Lord Lee had indicated the scope and functions of the Council, which the Minister again outlined. He added that Lord Clinton's motion was one which presented some difficulty in view of the fact that the Minister was not a member and had no power to initiate discussion. There was also the difficulty which everyone realised of publicity. When matters of policy in agriculture or any other Department of State were being considered, it was not desirable to have a full dress debate in public in the early stages. There was also the difficulty of time. Important decisions on agricultural and other matters were often taken in a short time, and the people concerned often pressed for a decision. The deputation from the National Farmers Union, which went first of all to Mr. Bonar Law and then to the present Prime Minister recently, certainly on the second occasion, made a great point of wanting a very early reply. The question of time was a factor which made it difficult to call an extraordinary meeting of the Council before any important decision was taken. Another thing which ought to be borne in mind was that it was not always easy to get Governments to initiate a policy, and if it was known that a policy had to be discussed in public before it was initiated, it was at all events worthy of consideration by the Council as to whether it was not likely that less instead of more might be done. He did not want to influence the decision of the Council one way or the other, but he thought it was his duty to put forward these considerations so that the Council would vote with its eyes open, knowing exactly what it was doing.

Mr. Ashby, Mr. F. J. K. Cross, Mr. R. Bruford, Col. Courthorpe, Lord Bledisloe, Mr. Christopher Turnor, Mr. Dallas, Alderman Davis, and Mr. Spraggon also took part in the debate. Mr. Cross suggested an amendment—

> "That a Committee of this Council be set up to consider and report in what manner the work of the Council may be made more profitable to the interests of Agriculture,"

which was seconded by Mr. Bruford. As a result of the discussion it was agreed that the proposed amendment should be treated as an addendum to the original resolution, which was then carried in the following terms:—

> "That in order that this Council may be enabled to carry out the duties for which it was appointed, it is essential that opportunities should be given for the discussion of changes in Agricultural Policy before the Government is committed to them; and that a Committee of this Council be set up to consider and report in what manner the work of the Council may be made more profitable to the interests of Agriculture."

It was decided to set up a Committee of eleven, as follows:—Mr. G. Dallas, Lord Clinton, Mr. Dan Crawford, Mrs. Hugh Middleton, Mr. P. Manwaring, Professor T. B. Wood, Sir Gilbert Greenall, Sir Merrik Burrell, Mr. W. J. Fitzherbert-Brockholes, The Hon. E. G. Strutt, and the Chairman, Sir Douglas Newton.

Summer Time.—Mr. Jas. Hamilton moved the following resolution:—

> "That this Council recommends that in the event of the Daylight Saving Bill being renewed for 1924, it shall operate from the first Sunday in May until the first Sunday of September. If it goes beyond that date, it should continue until the last Sunday in October on account of the potato harvest."

He said that a strong deputation had recently waited upon the Home Secretary, asking that the Daylight Saving Act might be extended and made permanent. What farmers asked was that townspeople should have the benefit of it with as little injury as possible to those engaged in farming, and therefore that the first Sunday in May should be the date of operation and the first Sunday in September the date of its conclusion. With regard to the first date, it should be remembered that for six months the workers engaged on milk-producing farms were engaged in feeding and milking cows in the dark, and the Daylight Saving Act meant throwing them back another month. In the North of England, farmers would like to see Daylight Saving end on the first Sunday in September because that was the harvest month. At whatever time they finished at night they had to start at the same time in the morning, because it was necessary to get the milk away. It frequently meant a 15-hour day. If this proposal was not agreed to, an extension of Daylight Saving to the last Sunday in October would be a benefit to the potato growers, as it would allow them more daylight in which to harvest their crops. He added that October was the only month in the year in which Daylight Saving could be of benefit to the farmer. The motion was seconded by Mr. G. G. Rea, C.B.E. In his speech he pointed out that Daylight Saving affected the arable farmer in haymaking and harvest time in the North of England. There was the extra hour of dew in the morning, which meant that something else had to be done to fill up that hour, and people were asked also to work abnormally long hours in the evening

to make up for it. The argument that farmers were not bound to abide by any particular hours was true, but there was a practical objection that it added immensely to the labours of the housewife, who is often the hardest worked person in the community. She would have two time-tables, one for the working members of her family and another for the children going to school. He was strongly of the opinion that Daylight Saving should be discontinued except for the four summer months. If, however, that was impossible, then he thought it should continue to the end of October, because at that particular time of year an hour in the evening was of more value to agriculture than an hour in the morning. In the course of the discussion, in which Lord Bledisloe, Mr. Cross, Mr. Nunneley, Col. Courthope and Mr. Spraggon took part, it was proposed by Mr. Nunneley, and seconded by Lord Bledisloe, that the second part of the resolution should be deleted. The amendment was put to the meeting and lost by 31 votes against 18. The original motion was then put to the meeting and carried.

Foot-and-Mouth Disease.—Mrs. Hugh Middleton then moved the following resolution:—

> "That this Council, while paying grateful tribute to the work of the Ministry of Agriculture in trying to eradicate Foot-and-Mouth Disease in this country, respectfully submits that, in view of the fact that years of strenuous effort on the part of the Ministry has failed to attain its object, it would appear that its policy is based on a wrong principle and should be reconsidered and adjusted on the following lines, viz.: That Foot-and-Mouth Disease continue to be a notifiable disease, but that owners be held responsible for the isolation and cure of their stock on the understanding that the goodwill and expert advice of the Ministry is at their service; and that the policy of slaughtering infected animals be discontinued and therefore no further compensation be paid."

The mover explained that she had raised the matter as she was anxious to throw some light on the problem of the disease. She was first able to make a close study of it in February, 1922, and had offered to give evidence before the Departmental Committee on Foot-and-Mouth Disease which sat in that year. She had been enormously impressed by the care which that Committee had given to their investigation and by the efforts of the Ministry in the eradication of the disease. But the fact nevertheless was that the machinery set up for this purpose did not work. She considered that if the disease were left to the courage, commonsense and perseverance of the British farmer, and, in a policy of isolation rather than slaughter, if use were made of the spirit of goodwill which existed between the Ministry and the farmers, the former giving all the expert advice it could, progress would undoubtedly be made and the disease wiped out. If this course were adopted, no compensation would be necessary as no animals would be slaughtered. In the course of her speech, Mrs. Middleton pointed out that the Committee's recommendations in regard to the proper disinfection of weighbridges, docks, railway trucks, etc., were not being carried out. She also referred to the brutal methods which had been employed in some cases in the slaughtering of animals infected by, or suspected of, the disease. The motion was seconded by Alderman T. Davis, and a discussion followed in

which the Minister, Mr. Patterson, Alderman Carter, Mr. McCracken, Mr. Egerton Quested, Sir Merrik Burrell, Mr. German, Mr. Nunneley, and Mr. W. R. Smith, M.P., took part. Mr. Patterson pointed out that clearly in the early stages of an outbreak safety lay in immediate slaughter, and that while this was maintained, compensation must be paid. The only point he wished to raise was whether the time had not arrived when the authorities should seriously consider whether they ought to carry on with the policy of slaughter. The test of any policy was its success or failure, and he was afraid that the Ministry would shortly be driven to the conclusion that the slaughter policy was not successful.

The Minister said he could not allow certain statements which had been made by Mrs. Middleton, though made in good faith, to go forth without a word of protest. There was no ground, he was informed, for any accusation of cruelty. At the same time, he would gladly look into the details of any cases which Mrs. Middleton would give him. With regard to the merits of the slaughter policy, the question was one on which the opinion of the Council would be exceedingly valuable. The experience of those who had tried it was that isolation on a large scale broke down. It was quite true that a pedigree herd could usually be isolated because people who kept pedigree herds had the very best equipment and a fairly ample staff of men; but to isolate in every case with an enormous number of outbreaks was quite impossible. Without slaughter, they would have Foot-and-Mouth Disease always with them. The Government was prepared to adhere to the policy of slaughter up to at least £1,500,000. The Ministry were taking all possible steps to expedite slaughter in the bad areas—Shropshire and Cheshire. The improved measures had had considerable effect in the last few days. He agreed with the mover of the resolution that everything possible ought to be done in the way of investigation and research, and the Government was going to ask the highest medical authority to act in consultation with and to advise the Ministry. Mr. McCracken moved an amendment to the resolution:—

> "That the Ministry of Agriculture be requested to use all the means at their disposal in the direction of research into Foot-and-Mouth Disease, and that meanwhile the Council leave the matter in their hands."

Mr. Nunneley seconded the amendment, giving particulars of the very grave losses which he had sustained in his early farming years. He added that anybody who knew the condition of the herds of the country in the years from 1868 to 1882 would not advise any Minister to do away with the policy of slaughter. The amendment was by leave of the Council withdrawn.

Sir Merrik Burrell then moved a further amendment:—

> "to omit all words after 'respectfully' in the original motion, and substitute the following: 'urges it to continue the policy of slaughter until such time as the Veterinary Authorities recommend otherwise.'"

He stated that this was the sense of the absolutely unanimous opinion expressed at the general meeting of the Royal Agricultural Society on the previous day. Mr. German seconded this amendment, stating that he had been at a meeting at Crewe last week to discuss the question with those who were suffering more than anybody else in England on account of the disease, and after a very long discussion, a resolution

was carried leaving the matter entirely with the Ministry to proceed in such manner as it thought best. He suggested that the Minister be asked to place at the disposal of the Press an absolutely impartial memorandum on the whole question, which by the courtesy of the Minister he had read. Sir Merrik Burrell's amendment was then put and carried. It read as follows:—

> "That this Council, while paying grateful tribute to the work of the Ministry of Agriculture in trying to eradicate Foot-and-Mouth Disease in this country, respectfully urges it to continue the policy of slaughter until such time as the Veterinary Authorities recommend otherwise."

Reports.—The Report containing further information as to the Ex-Service men settled on the land in England and Wales which had been laid before the Council was received; also the Half-Yearly Report (No. 6) to the Council of the Proceedings of the Agricultural Advisory Committee for England and Wales, a copy of which is printed below. Mr. Fitzherbert Brockholes suggested on paragraph 10 of the Half-Yearly Report that it would be advisable that four of the eight persons interested in the Milk Industry which were to be appointed by the Minister to the Milk Advisory Committee should be actual producers. At this point, Mr. Robbins raised the question of a successor, and there being found to be not one-third of the members present, the proceedings terminated.

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AGRICULTURAL ADVISORY COMMITTEE FOR ENGLAND AND WALES.

THE following is the half-yearly report (No. 6) to the Councils of Agriculture for England and Wales, on the proceedings of the Agricultural Advisory Committee:—

The Agricultural Advisory Committee has met six times between the date of the last report, which was issued on the 3rd May, 1923, and that of the present report—viz.: on 6th June, 11th July, 1st August, 10th August, 3rd October and 7th November, and has discussed the following subjects, with the results stated:—

(1) **Stimulation of Urban Interest in Agriculture.**—At the last meeting of the Council, a resolution was passed:—

> "That it is necessary to stimulate on the part of urban and industrial communities greater interest in the development of agricultural England."

This resolution was referred by the Council to the Agricultural Advisory Committee to consider what steps could be taken to give effect to it. The Committee discussed the matter and decided that, in addition to the work which was at present being done by various unofficial organisations, special steps might be taken through the British Empire Exhibition of next year, and the Committee made a recommendation to the Ministry accordingly. Two members of the Committee were eventually nominated to sit on a Committee "to advise the Ministry and to co-operate in the preparation of the agricultural exhibit at the British Empire Exhibition."

(2) **Importation of Foreign Potatoes.**—A resolution was passed at the last meeting of the Council :—

> "That the Government be urged to take steps to avoid disaster to the potato industry of the country."

The Committee was informed that the Government had already announced that it was not prepared to place an import duty on foreign potatoes at the present time, but that the position would be reconsidered if need should arise after this season's crop had been gathered. In these circumstances, the Committee did not think that it could usefully take further action.

(3) **Charges for Licences to sell Certified Milk, &c., under Ministry of Health Order.**—It was reported to the Committee that the Ministry had taken up this matter with the Ministry of Health, but that there appeared to be no prospect of reducing the charges at the moment. It had been laid down by the Treasury that the services of inspection, &c., under the Milk (Special Designations) Order should be paid for by those concerned. Furthermore, the fee for "certified milk" licences was £5, and that that fee was the highest in the scale of charges. So far, no more than 50 licences for the sale of this class of milk had been issued, and the holders of these who sold the milk at 6d. a pint would very soon recoup themselves for the cost of the licence. It was pointed out that the new Order setting out the charges would have to be laid before Parliament for a period during which objections to it might be taken, and that in the circumstances, the matter was one which might very properly be raised in debate in either House.

(4) **The Grant of £850,000 for Agricultural Education and Research.**—The question of supplying Sparsholt Farm Institute with a new Hostel at an expenditure of £14,000, of which three-quarters would come from the Fund, was considered. It was suggested by the Committee that a limit of £10,000 should be fixed, subject to the Ministry making any small increase later, if such a course were found to be necessary.

The point was raised in Committee as to whether, in view of the fact that the Fund was not guaranteed after March, 1927, certain scientists who were working under it might, unless they were assured of continuance of service after that date, relinquish their work in favour of more permanent posts elsewhere. It was stated on behalf of the Ministry that although in the nature of the case no absolutely definite undertaking could be given, there was not any reasonable room for doubt that the Government in 1927 would uphold the undertaking which had been given by the Treasury that schemes started out of the fund recently placed at the disposal of agricultural education and research would continue to be maintained after 1927.

(5) **The Proposed Tax on Imported Malting Barley.**—The Committee considered correspondence between Government Departments which showed that unforeseen difficulties had arisen in the way of levying an Excise duty on malting barley, and decided to leave the matter in the hands of the Ministry to make the best arrangement possible in the circumstances. Later, alternative schemes were discussed and recommendations made. At a meeting on the 3rd October, however, the Minister informed the Committee that a Departmental Committee was being set up to consider the various methods which had been suggested of levying a Customs duty, not an Excise duty, upon imported malting barley and to report what in their opinion is the

most convenient form of duty. The Advisory Committee asked that the Departmental Committee might be requested to report as soon as possible.

(6) **Imperial Economic Conference.**—At the meeting on the 11th July, the Committee considered various memoranda circulated in connection with the items of the preliminary agenda for the Imperial Economic Conference. It was agreed at this meeting that a separate small Advisory Committee should be appointed for the purpose of advising on all agricultural questions which would or should be brought up at the Conference. Five members from the Agricultural Advisory Committee were nominated for this purpose (viz., Lord Bledisloe, Mr. McLaren, Mr. Robbins, Mr. W. R. Smith and Mr. C. D. Thompson), with power to co-opt two representatives of the Agricultural Committee of the House of Commons (Mr. Pretyman and Mr. Percy Hurd were subsequently appointed), and, later, Sir Merrik Burrell, of the Livestock Defence Committee.

This Sub-Committee considered memoranda and advised on several matters, including Imperial Agricultural Policy and Imperial Preference, Overseas Settlement, Importation of breeding and store stock from Canada and the Dominions. It also had unofficial meetings with representatives of Dominion Agriculture who came to this country in connection with the Economic Conference.

(7) **Report of Agricultural Machinery Committee.**—A Memorandum was circulated stating and discussing the principal recommendations of this Committee, from which it appeared (1) that the Ministry could not undertake to carry out machinery research direct, (2) that before any progress could be made a centre for the new Agricultural Machinery Research Institute, which the report proposed, had to be decided upon, (3) that the Ministry had selected Oxford as the best centre for the Institute. The Committee discussed this choice and some of them were in favour of Cambridge as the centre. It was stated, however, that the Ministry was now fairly definitely committed to their offer to Oxford and could hardly withdraw it. It was finally agreed that the Committee should ask the Ministry to reconsider the whole matter if it proved, on further enquiry, that the present negotiations with Oxford had not gone too far for this to be done.

(8) **Importation of Breeding Stock.**—Lord Ailwyn at the meeting on 1st August brought before the Committee the following resolutions which had been passed by the Council of the Royal Agricultural Society :—

> "That this Council is strongly opposed to the suggested importation of breeding stock from other parts of the British Empire."
>
> "That the Council of the Royal Agricultural Society of England strongly protests against any renewal of the practice of giving pledges at the Imperial Conference to the detriment of British Agriculture, without either the knowledge or consent of Parliament or British agriculturists."

Mr. McLaren also brought before the Committee the following resolution which had been passed by the Shorthorn Society :—

> "The Council of the Shorthorn Society deplores the action of the Government in proceeding to the preparation of an Order for the admission of breeding cattle from Canada before having fully ascertained the opinion of all those primarily interested in the breeding of cattle in

this country, and before experience has shown the effect of the admission of store cattle. The Council is of opinion that the admission of bulls is indefensible, and that there is at present no shortage of breeding females such as alone could justify the precipitation of the Government is preparing this fresh Order, especially at a time of crisis in agricultural affairs for which no effective remedy has yet been suggested. The Council is of opinion that should the Government unfortunately determine to put the Order in force no advantage would be gained by stipulating for an abortion test, and that if there is to be a test for the detection of tuberculosis its precise nature should be clearly defined."

The subject of these resolutions was discussed. It was pointed out that the Importation of Animals Act passed last year had made provision for the admission of breeding stock, and that, therefore, the question to be settled was rather on what terms they ought to be admitted than whether they should be admitted at all. The Committee, however, after further discussion passed the following resolution :—

"That this Committee is strongly opposed to the suggested importation of breeding animals from other parts of the Empire."

It was understood that this Resolution was a re-statement of the Committee's views upon the matter, but would not, if the Government decided that there was no other course but to make the Order proposed, debar the Committee from expressing an opinion on the terms of the Order. It was also decided that a special meeting of the Committee should be convened at an early date, to discuss the whole situation in regard to the importation of breeding and other cattle.

At the special meeting, the Minister referred to the resignation from the Committee of Lord Bledisloe, which had taken place over the question of the admission of breeding stock because of the confliction which His Lordship felt between his duty as a member of the Council of the Royal Agricultural Society and that as a member of this Committee. As a result of a careful consideration of all the circumstances, the Advisory Committee came generally to the conclusion that they saw no reason to depart from the views which they had expressed at the last meeting. At the special meeting the Committee had the benefit of the assistance of Sir Merrik Burrell, who had been invited to attend. The Minister intimated that he saw no alternative but that the Government should proceed on the lines of allowing reciprocal importation of pedigree stock between the Dominions and the United Kingdom.

The resignation of Lord Ailwyn was laid before the Minister at the next meeting of the Committee, when the Minister expressed the regret which the Committee felt at the resignations of both Lord Ailwyn and Lord Bledisloe over the question of the importation of breeding stock.

At the meeting on 7th November, the Minister reported to the Committee that it had been agreed at the Imperial Economic Conference that the matter should be proceeded with on the lines of reciprocal arrangements for the admission of pedigree stock, and that, with regard to store stock from Canada, the difference between the accepted meaning of fat and store stock should be defined as accurately as possible.

(9) **Foot-and-Mouth Disease.**—At the meetings of the Committee on the 3rd October and 7th November reports were made as to the position and prospects in relation to the disease; which were considered and discussed by the Committee.

(10) **Milk Advisory Committee.**—The recommendation in Lord Linlithgow's Committee's Report on Milk and Milk Products for the appointment of a Standing Milk Advisory Committee was considered, and it was agreed that the Committee should consist of official representatives, with eight persons interested in the milk industry to be selected by the Minister.

(11) **Agricultural Conference at the British Empire Exhibition.**—The Committee agreed that the Ministry should obtain the views of the National Farmers' Union and the Royal Agricultural Society on a proposal to hold an agricultural conference at which administrative and technical agricultural questions should be discussed.

(12) **Proposed Subsidy to Arable Agriculture.**—The Committee at their meeting of 7th November discussed the letter from the National Farmers' Union on the position of arable agriculture, which the Minister had transmitted to the Prime Minister and which would shortly be considered by the Cabinet. Certain views were voiced by members, but it was agreed that the Committee would not at this stage express an opinion on the suggestions in the letter but would if required by a Cabinet Committee submit them, covering points of detail, at a later date.

(13) **Power of County Councils to make Restrictive Regulations on the Movement of Animals.**—The position in this matter was considered and the question raised as to whether the old Order of the Ministry which gave the Local Authorities this power should not now be modified so as to require them to get the Ministry's approval to draft orders before issue. The Committee agreed that that appeared now desirable but the matter was adjourned for certain further information.

(14) **Report of the Proceedings of the Various Advisory and Departmental Committees set up by the Ministry.**—One report was received by the Committee under this head in the period under review. It was dated 24th July, 1923, and dealt with the proceedings of the Agricultural Prices Committee, the Tribunal of Investigation into Agricultural Conditions, the Agricultural Meteorological Conference, the Basic Slag Committee, the Electro-Culture Committee, the Agricultural Research Council, the Conference of Advisory Officers, the Advisory Committee on Agricultural Science, the Methwold Management Committee, the Allotments Advisory Committee, the Warble Fly Committee, the Central Scholarships Committee, the Horticultural Advisory Committee, the Poultry Advisory Committee, and the National Poultry Institute Advisory Committee.

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TURKEY REARING ON LIMITED AREAS.

E. T. BROWN.

AN impression which is firmly fixed in the mind of the modern poultry-keeper is that it is essential to have unlimited space for turkey raising. This belief, like many another founded upon the paucity of one's knowledge, has now been exploded, and it has

been proved that turkeys can be raised equally successfully on a limited area of land as when given a free range.

The one thing lacking in the past was to discover a system which would bring about the desired results. That such a system could be found was indicated by the enormous advance that has been made in the production of eggs from ordinary fowls. Twenty years ago winter eggs were few and far between; to-day tens of thousands of pullets and hens lay throughout the cold weather. This has been rendered possible, not altogether by breeding, but principally by the alterations that have taken place in management. Early hatching, the provision of a scratching-shed for use in bad weather, a method of feeding that encourages the birds to take exercise, the judicious use of animal foods, such as meat meal and fish meal, and artificial illumination of the house during the dark evenings, have conjointly made the winter-egg yield almost equal to that of spring and summer. The great influence of management is an undisputed one.

The only reason why a system of rearing turkeys on small areas has not been generally practised hitherto is that the average poultry-keeper is conservative to a degree, and firmly believes that wide liberty for the birds is essential to success. Being convinced on this point he has never troubled to give the matter a second thought.

A System That Works.—One of the most successful turkey raisers I know only possesses a total of 8½ acres of land, of which close upon 3 acres is woodland. The soil is medium to light, naturally well-drained, and the district is a kindly one as regards climatic conditions. These are, of course, contributory factors, and without them results would not be nearly so good.

The best breed for the purpose is the Cambridge bronze. A very important point is to rely upon fully matured birds for the breeding pen. The hens should not be less than 3 years old: the stags 2 or 3 years of age. The male, too, must be unrelated to the hens. In-breeding weakens the stamina and undermines the constitution.

The breeding flock is boarded out from June to February on a neighbouring farm. This is not an essential part of the system, but when it can be done it is an advantage. The pen is brought in at the beginning of February, so that the birds can grow accustomed to their surroundings before the laying season approaches. The breeding birds are housed in a large

open-fronted shed, each bird being allowed 12 sq. ft. of floor space. This house is placed at one end of a wire-netted run 100 ft. long by 18 ft. wide. The run is planted with fruit trees, which help considerably to keep the ground pure and sweet.

Turkey hens do not like to share a nest with other birds. The necessary number of crates, with a sufficiently large hole cut in one end, should be dotted about the run. Each hen will select a nest for herself and stick to it throughout the laying period. The nests should be visited every day and the eggs removed.

Feeding the Breeders.—As a grain ration the breeding birds are fed upon oats (2 parts) and wheat (1 part), this being given half in the morning and half in the late afternoon. For the remainder of the day they are supplied with dry mash in a self-feeding hopper. Any good dry mash that is employed for ordinary laying hens answers admirably. If soured milk or soured skim milk be available, the meat meal or fish meal should be omitted from the dry mash. If either of these can be obtained, it should be given at midday at the same time as a liberal supply of succulent green stuff is fed. On no account should the green food be omitted.

A supply of grit, oyster shell and granulated vegetable charcoal should always be before the birds. To keep the digestive troubles which are always lurking round the corner of every turkey house in their proper place, these three items should not be allowed to run short.

Hatching the Eggs.—As the eggs are laid they should be placed under reliable hens for incubation. A large hen will cover a dozen turkey eggs easily, but it is better to limit the number to eight or ten. Removing the eggs encourages the turkey hens to lay a larger number; if one should show signs of broodiness she can be broken in the usual way even more easily than can a general-purpose breed fowl. During the last four or five days of incubation the eggs should be damped with warm water just before returning the sitting hen to her nest.

It is advisable to set a number of hens at the same time. When the hatches are all completed the best hens should be chosen and each one given 20 to 25 turkey chicks to mother. These hens can be placed in double coops, but a better plan is to employ a brooder house divided into compartments 2 ft. wide, with long open runs of a similar width in front. Each section accommodates a hen and her brood for the time being.

By the time the youngsters are a month old they are too large

to nestle under the hen, but they still require looking after. The partitions in the brooder house are, therefore, taken away and three or four batches of turkey chicks are given to one hen —the best for mothering purposes—and allowed the run of the whole brooder house. The partitions, too, in the runs are removed, thus giving one run ¼ acre in size.

The youngsters remain in the brooder house until they have "shot the red." As soon as this period has been passed successfully the young turkeys are taken to the woodland run. This is about 3 acres in extent and fenced with 6 ft. netting. The birds are housed in open-fronted sheds, but whenever the weather is at all fine the birds prefer to sleep in the branches of the trees. The provision of sheds is, however, essential in case of bad weather.

Importance of Correct Feeding.—The system of feeding adopted during the early days is of great importance. The following is the plan adopted by the breeder referred to above:— The hen requires a good feed of wheat and oats both morning and afternoon for the first three weeks; this is taken for granted. When the brood is two days old a little wet mash, consisting principally of soaked biscuit meal and Sussex ground oats is supplied upon a board in the morning, again about noon and for a third time about 4 p.m. In addition pinhead oatmeal is supplied at 10 a.m. and 2 p.m. Skim milk is used for mixing the wet mash, and once a day a teaspoonful of Epsom salts is dissolved in this for each twenty-five birds.

On the third day, the feeding is practically the same, but when the wet mash is fed sufficient chopped dandelions, nettles or onions are mixed with it to double its bulk. From this time onwards soured skim milk, as well as fresh water, is kept constantly before the youngsters.

At ten days old the feeding times are reduced to three a day. The first feed is wet mash, pinhead oatmeal at noon, and wet mash again in the late afternoon. The green food is still added to the mash at each meal. At this time the daily dose of Epsom salts is reduced to twice a week. When the chickens are three weeks old the pinhead oatmeal is mixed with an equal quantity of a good dry chick feed. The grain feed is now given in the morning and as a last feed, and at noon fresh, crisp, succulent green stuff is supplied. Wet mash is only given once a week at midday: this so that a weekly dose of salts, which must be increased as the birds grow, can be given in a suitable medium. This is continued until the birds are removed to the woodland

run, the quantity supplied being increased as the needs of the birds call for a larger amount.

On removal to the woodland run the birds are given a feed of three parts oats and one part wheat in the morning and again in the afternoon; at midday they are supplied with as much green food as they will eat, together with all the soured skim milk they require. The weekly dose of Epsom salts is continued, this being given in soaked pinhead oatmeal as the afternoon meal.

Six weeks before the birds are due to be killed they are brought up from the woodland run and placed in the breeding pen. The food is the same, except that a little whole maize is added. Three weeks before killing the soured skim milk is used for mixing up the fattening wet mash which consists of equal parts of Sussex ground oats, middlings and bran, and not given separately as heretofore. The wet mash is fed at morning and noon and grain in the afternoon.

The Two Important Foods.—As will be seen by the foregoing the two most important items in the diet are soured skim milk and green food. It is impossible to lay too much stress upon the need for both of these daily right from the time the chicks are three days old until three weeks before they are killed.

During the year 1921 89 turkey chicks were hatched and 84 marketed; in 1922, 103 were brought out, of which 99 were successfully reared and marketed; this year, 117 were hatched and at the present time there are 114 strong, lively birds running in the woodland enclosure. And these numbers have been raised upon a total of $3\frac{1}{2}$ acres of land, the greater part of which is useless for any agricultural purpose.

Raising turkeys on small areas has been proved successful: and one may confidently expect that many others who have the necessary small area of land will take up this branch of the poultry industry.

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THE IMPERIAL FRUIT SHOW, 1923.

II.

J. TURNBULL and A. WHITING,
Ministry of Agriculture and Fisheries.

Apples.—*United Kingdom Section* (cont.).—*Bramley Seedling.*—The first prize in the half-barrel class went to Kent for a fine exhibit of coloured fruit which gained full marks for pack. One barrel was not quite up to the others, and the size was not quite uniform. The second prize lot from Wisbech were well packed, green Bramleys, typical of this variety at its best. The price realised, 33s., exceeded that of all other exhibits of cooking apples in the Show, except Kentish Blenheim Orange, which it equalled. The third lot came from Malvern and were also fine specimens, well packed but rather irregular in size. These three exhibits stood out above all other Bramleys in the Show. Some from Norwich approached them in quality of fruit, but the pack was slack and very low—probably due to woodwool at the bottom of the barrel.

In the bushel class the first prize was awarded to very highly coloured Bramleys hardly typical of the variety and packed much too high above the rim. Towards the close of the Show it was noted that this exhibit was rapidly going off condition The second prize went to West Midland Bramleys in very good condition, but very uneven in size and low in the pack. The third lot were from East Suffolk, Bramleys of typical colour and shape, in fine condition, but pack rather uneven. Mention should also be made of the Kentish exhibit which was first in its own section and realised the same price as the winner of this class. They were very well packed, in very good condition, but rather small.

Newton Wonder.—The winner of this half-barrel class came from Kent. The fruit was on the small side, but of fine colour and the pack was almost perfect. This particular exhibitor showed very good packs in every package, but in half barrels no other exhibitor approached the perfection of his pack. To this was due not only the very large number of prizes won, but also the very high prices realised at the auction sale by his exhibits. The second prize in this class went to Malvern for fine highly coloured fruit, a little uneven in size and pack. This exhibitor's Newtons were almost perfect specimens in every respect except for the prevalence of bitter pit. The third prize

exhibit from Wisbech consisted of very fine, large Newtons. The pack was very uniform in colour and size, but a bit low and slack.

In the bushel class the first prize went to Evesham for a very well packed exhibit of highly-coloured Newtons. They were rather off condition and showed bitter pit. The second from Kent were also well packed though lacking in crown, highly-coloured and rather on the small side. These made a considerably higher price.

Lane's Prince Albert.—The first prize in the half-barrel class went to Kent for very highly-coloured Lanes, which, however, were not typical of the variety. They were beautifully packed, but not uniform in size. The second from Herefordshire were also very highly coloured, but not typical of the variety in colour or shape, and too forward in condition. The second prize West Midland Lanes adjoining this exhibit appeared to be in better condition and of more typical colour and finish. The pack was full but slack and not uniform in size. The Norfolk Lanes which were placed third, were typical Lanes in good condition, but the grading was very uneven both in size and colour. If the prices realised at auction are compared with the awards, it is apparent that in all these classes for cooking apples, the judges attached considerably more importance to exceptional colour than the buyers did. Exceptional colour is usually—though not always—gained under circumstances which also cause poor condition of the fruit, and this is a point which should be borne in mind in future.

Any other Variety.—In half barrels the first prize went to very fine, large, well coloured Blenheim Orange in good condition, from Evesham. These were typical of the best of this variety as sent by this exhibitor. The second prize from Kent was exceptionally well packed and realised a much higher price. The third prize also went to Kent.

In bushels the first prize went to well packed typical green Lord Derby from Wisbech, but like other exhibits of this variety it was too forward in condition and showed a little bitter pit. Second and third prizes went to Kent.

Small Holders Classes.—There were but few entries in these classes, the numbers in the three classes being as follows:—

		Kent.	*East.*	*West.*
Class 15.	Half sieves dessert apples ...	1 ...	3 ...	2
„ 16.	„ barrels cooking „ ...	— ...	1 ...	—
„ 17.	Bushels „ „ ...	1 ...	3 ...	1

Class 15 was won with Cox's Orange by the same Berkshire grower than won in classes 1 and 6. He was also second in class 17. Second in class 15 went to Wisbech and the third prize was divided between two growers in Essex. Class 16 went to a Cambridgeshire grower of some fine Lanes and he gained a second in class 17 with the same variety. In class 17 the first prize was not awarded and the third went to Droitwich.

Other Sections.—In the Overseas Section the Associated Growers of British Columbia won ten classes and tied for first place in another out of 16 classes. This is a most remarkable achievement.

Pears and Other Fruit.—In the United Kingdom Section pear classes, all three prizes went to Kentish growers, the winner showing a superb exhibit. In Conférénce pears the third prize only was awarded to a Warwickshire grower, and in any other dessert variety, second and third prizes went to Evesham and East Suffolk. In any variety of cooking pear the second and third prizes went to Kent and East Suffolk. In tomatoes the second prize only went to a Waltham Cross exhibit. In grapes the third prize only was awarded and that went to Worthing.

In the Channel Islands section, one entry gained first prize for dessert pears and there were no entries of grapes. Two prizes only were awarded in the tomato classes for indoor and outdoor grown fruit.

In the Ulster Section the packing showed remarkable improvement on last year. First and second prizes went to the same two growers in each class.

Auction Prices.—Interesting lessons may be learned from a comparison of the prices realised at auction with the score card points, with the awards and with the different packages used. It should be borne in mind that prices realised are no more infallible than the judges' decision. The prices do not compare in any way with the score card marks as was the case last year. In several cases of great discrepancy between prices and score card marks, we have a good recollection of the quality of the exhibits and we have no hesitation whatever in supporting the judges' opinion. The view has been widely held that the prices are a kind of acid test of the value of the judges' decisions. After making these comparisons, however, we are confident that the judge is more often right than the buyer—as should be the case.

If the prices are compared with the prizes in the Kent, East, and West Sections, the results are satisfactory. If, however,

the prices are compared with the awards in the United Kingdom Section, curious discrepancies are to be found. A difference of 2s. would hardly arouse comment, but there are several cases where exhibits have been placed ahead of others which realised from 5s. 6d. to 10s. and in one case 13s. more. Had the judges been different, an obvious explanation would arise: but they were not. The same judges judged the same variety in the three sections and in the United Kingdom section as well. In the three sections their verdict is borne out by the prices, but in the United Kingdom section it is not. Many of these differences are undoubtedly due to bad judgment on the part of the buyer, but there are a few in which we would support the buyer's view. In the majority of these cases the exhibits had one or both of two characteristics—they were either of exceptionally high colour or in poor condition or both. Conversely the exhibits which the buyers valued higher than the judges, were in first rate condition, but not specially noted for colour. It is certain that if there are any defects in the score card, they would be revealed in the United Kingdom section, where competition is necessarily keener than in the three home sections. It would appear that the score card should be altered by reducing the number of points given for colour and increasing those given for condition.

Another point worthy of consideration, is whether it would not be better for judging if all apples of one variety were staged together, with sub-headings for the three home sections.

In order to obtain a fair comparison of packages, it seems better to omit prize winners—the price of which is weighted by the prize tickets—and compare unplaced exhibits only. Cox's Orange are a law unto themselves, but a fair comparison cannot be obtained as there were so few entries that nearly all had prize tickets of some kind attached.

Half sieves of "any other variety" made 4s. to 6s. which, after deducting 1s. 6d. for package, leaves 2s. 6d. to 4s. 6d., equal to 5s. to 9s. a bushel. Boxes made 9s. to 14s. equal to 8s. 3d. to 13s. 3d. per bushel. This favours the box, but all these prices were below recent market prices and can hardly be considered a fair test.

A comparison of cooking apples is better owing to the larger classes.

		Average price for unplaced exhibits.			Per bushel after allowing for package.		
		Barrel.	Bushel.	Box.	Barrel.	Bushel.	Box.
Bramleys ...	Kent	15/6	10/9	13/6	9/4	8/3	12/9
" ...	East	17/10	15/10	15/-	10/11	13/4	14/3
" ...	West	17/6	10/3	13/6	10/8	7/9	12/9
Newtons ...	Kent	17/-	11/6	—	10/4	9/-	—
" ...	East	18/-	12/6	18/-	11/-	10/-	17/3
" ...	West	17/-	12/-	12/-	10/4	9/6	11/3
Lanes ...	Kent	16/3	—	13/-	9/10	—	12/3
" ...	East	17/3	—	12/-	10/6	—	11/3
" ...	West	17/-	—	—	10/4	—	—

The averages of these per bushel net are :—

In boxes	13/1	per bush.
" barrels	10/4	"
" bushels	9/8	"

showing a small advantage for barrels over bushels and a considerable advantage for boxes over both.

The average prices of exhibits in classes 1-14 in the three sections are also of interest :—

Section.	1st.	2nd.	3rd.	Unplaced.
East	23/6 ...	18/2 ...	14/4 ...	13/8
Kent	23/8 ...	16/- ...	13/3 ...	12/6
West	21/8 ...	15/6 ...	13/6 ...	11/2

Sale Catalogue.—In view of the poor prices realised for fruit of such high and uniform quality, it would appear that some re-arrangement of the sale catalogue might bring about an improvement. It would certainly facilitate matters if the sale of one variety was completed before passing on to another—*e.g.*, Lots 1-50 Cox's Orange Pippin, Lots 51-71 Worcester Pearmain and so on. This, together with all apples of one variety staged together, as mentioned above, would enable buyers to see at a glance exhibits suitable for their requirements. All varieties in " any other variety " classes should, in future, be named in the auction catalogues. This is borne out by the low prices realised for Cox's in Class 1 of the British Empire Section. This variety together with Allington Pippin other than prize lots, averaged no more than 10s. 8d. per box. Similar examples are to be found in the sale of the culinary class in the same section.

The British Empire section should be sold first and not last as under the present system, which necessitates a buyer waiting to the end of the sale to purchase the best apples in the show.

Packages.—The general improvement in box packing and the increasing popularity of the non-returnable package, have

done much to favour the elimination of bushels and half sieves at future shows. In the first place, the cost of the new wicker is more or less a dead loss to the exhibitor and secondly, elaborate methods of covering and lining the baskets to prevent bruising, are adopted by many growers—a practice which does not comply with the rule that "All exhibits shall be packed under commercial conditions." Also, there is unfortunately a considerable amount of pilfering due to easier access to the fruit.

The proved suitability of the box for high grade culinary varieties, as shown in Class 2 of the British Empire Section, even goes so far as to suggest the confining of the Show to the box package only, until such time as a suitable non-returnable barrel can be made at an economic price.

It may be argued that the smaller grower has not sufficient fruit to select from to enter in the seven-box or barrel classes, but the difficulty can easily be overcome by substituting a four-box class in the case of half sieves and a four-barrel class in place of seven bushels, growers of more than 20 acres being excluded.

"Any Other Variety" Classes.—Surely it is an anachronism to have any other variety classes at a commercial fruit show. Some exhibitors contend that these classes are especially of interest from the point of view of introducing new varieties. The entries at each of the three Imperial Fruit Shows, however, have brought nothing of merit and usually consist of old well-known sorts, which are now little planted. Why include varieties none of which is of sufficient commercial value to have a named class for it? It is suggested that in place of the "any other variety" dessert classes, a class for 3 boxes of any dessert variety—season to follow Worcester Pearmain and precede Cox's Orange Pippin—be made. In this way a suitable variety to fill present requirements might be forthcoming in course of time. The class for King of the Pippins might be reinstated, or it might be included with one of the other varieties.

"Any other variety" culinary classes seem to serve no useful purpose and might be withdrawn from the schedule entirely. A new interesting class might be instituted, however, to comprise one ton (56 boxes) of Bramley, Newton or Lane's Prince Albert, open to the British Isles. Growers of Blenheim Orange, Annie Elizabeth, Lord Derby, Bismarck or King Edward VII might wish to be included, and this point might be considered.

Rules and Disqualifications.—There are so few exhibitors now who fail to comply with all the rules, that in future all

rules should be rigidly enforced. Admittedly it is hard luck for the sender of a good exhibit to be disqualified, possibly through a pure oversight, but after all he has only himself to blame, and it is a good deal harder for the other exhibitors who have taken great pains to comply with all rules, to be beaten by a very small margin by such a sender. In order to simplify the awarding of special prizes with peculiar limitations (*e.g.*, growers in certain counties. or members of certain associations, or showing both culinary and dessert), there should be a rule to the effect that "No special prize which is not open to all competitors in a section shall be awarded to any exhibitor who fails to state on his entry form the special prizes for which he is eligible and the reason of his eligibility."

Rule 12 was intended to apply to apples in boxes only. "For apples diagonal on-side packs only may be used." At least one exhibitor thought this applied to all packages, in spite of the fact that it is impossible to use a diagonal pack in a round package. This sentence ought therefore to be re-written. "Diagonal on-side packs only may be used for apples in boxes" would do. This pack is favoured because it is standard for box packing.

It is now recognised that "ringing-in" in round packages is a commercial proposition and if any round packages continue in the show, it might be made compulsory. In connection with this point, it is to be noted that many exhibitors put a thick layer of wood wool in the bottom of the package so as to get the right height. This was the chief cause of slack packs. The only way to build a firm pack to the right height, when this does not happen with all the apples turned the same way, is to pack some layers flat and some on-side. The last layer should preferably be on-side as it gives a better appearance. The correct way to retain the "crown" when "ringing" is to pack the centre apples tightly from the bottom up. Choosing larger sizes for the top centre apples is useless if the crown is not built all the way up. Wood wool in boxes, barrels or wickers is a delusion and a snare. Sparingly used it can be made to serve a useful purpose, but over anxiety makes the exhibitor use too much. Inside the package, anything more than a few strands causes a slack pack and on the top of the package the dusty material contained in it is a nuisance to the user's exhibit and all surrounding it. The use of wood wool in these packages and of hay or fodder should be prohibited entirely. The cleanest and best material to use is stiff wheat straw, laid straight across the package and

with the ends clipped off after tying down. Hay becomes musty with the sweat of the fruit. A card should be sent to each exhibitor stating the packing rules shortly and exactly and for what bad points he will be disqualified. This would avoid much misunderstanding and disappointment.

As a guide to exhibitors on the controversial question of size, we would suggest that a judge's rule should be made to the effect that the following sizes will receive full points for size :—

Cox's Orange Pippin	...	...	150–200 per box.
Any other dessert	...	...	150–175 ,,
Any culinary variety	...	...	80–96 ,,

As a further guide a packing card showing the counts to the various packs might be included in the schedule.

In conclusion, we would emphasise the importance of several points :—

(1) Reduction in the number of classes, especially in the case of "Any other Varieties."

(2) The adoption of the box for culinary variety classes.

(3) Tightening up of the Rules.

(4) Standardisation in judging.

(5) Increased opportunities for the public to purchase exhibition fruit.

* * * * * *

NOTES ON MANURES FOR JANUARY.

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Phosphates and Potash for Grass Land.—The value of phosphates, either alone or with potash, for improving the yield and quality of grass land is well known. The increase in clovers following such treatment is usually marked; and under favourable conditions, as, for example, in a soil containing chalk and well supplied with available potash, the response is very considerable. On such a soil at Horndon, Essex, the following results were obtained by Robertson :—

Treatment.	*Hay.* cwt. per acre.	*Clover.* per cent.	*Grasses.* per cent.	*Weeds.* per cent.
Unmanured ...	6.4	8.7	81.4	9.9
High soluble slag ...	23.2	45.4	53.3	1.3
Gafsa phosphate ...	22.3	63.8	32.0	4.2

On the continuous hay plots at Rothamsted the average yields for a recent 10-year period, and the botanical analysis for a typical year were :—

Treatment.	*Hay (1st crop).* cwt. per acre.	*Clover.* per cent.	*Grasses.* per cent.	*Weeds,* per cent.
Unmanured	10 ...	5.8 ...	54.3 ...	35.6
Superphosphate only ...	13 ...	7.5 ...	55.9 ...	33.6
Superphosphate + sulphates of soda and magnesia ...	17 ...	10.6 ...	62.7 ...	25.8
Superphosphate + sulphates of soda and magnesia + sulphate of potash ...	26 ...	16.9 ...	68.0 ...	14.6

In this case it is seen that to maintain the yield and quality of permanent meadow land, potash is necessary as well as phosphate, and that salts of soda and magnesia, while not so effective as potash for this purpose, have still a definite value.

When land treated with phosphates and potash is grazed, similar results are observed in the herbage. The larger growth and improved quality enable more stock to be carried, and the production of the pasture for milk and meat is increased. The results of a few experiments may be quoted:—

PRODUCTION OF MILK.

Centre.	*Treatment per Acre.*	*No. of Seasons of Experiment.*	*Increase per Acre per Season over no Manure Land.* Actual gal.	Per cent.
Klonakilty Agricultural School	10 cwt. slag	3	63	21
Klonakilty Agricultural School	7½ cwt. slag	2	102	66
Midland Agricultural College	4 cwt. superphosphate 1½ cwt. sulphate of potash	4	93	58
Harper Adams Agricultural College	2½ cwt. superphosphate annually	3	33	19
	2½ cwt. superphosphate 1½ cwt. sulphate of potash annually	3	56	32

PRODUCTION OF MEAT.

			Actual Increase Live weight lb.	
Cockle Park, sheep grazing	10 cwt. slag applied on 3 occasions	21	87	300
Saxmundham, sheep grazing	10 cwt. slag applied on 2 occasions	11	62	83

The experiments quoted above were costed and in every case the expenditure on manures was amply covered by the value of the extra produce. The slags used were of the high-grade,

high-soluble type, *i.e.*, containing from 30-40 per cent. of phosphate, 80 per cent. or more soluble in citric acid. Under present conditions slags are often obtained containing only about 20 per cent. of phosphate. Some of these low-grade slags are as soluble as the old high-soluble slags, but others are distinctly less soluble in citric acid. It is often asked whether the same results can be expected from low-grade as from high-grade slags. A large amount of experimental evidence is accumulating on this point and the general indications are that the low-grade slags of high solubility are much the same in their action as the high-grade slags if applied at the same rate of phosphate per acre (*e.g.*, 10 cwt. of a 20 per cent. slag provides the same amount of phosphate as 5 cwt. of a 40 per cent. slag). The low-grade slags of low solubility have not usually come into action as quickly as the high-soluble types, and do best on peaty soils and in wet districts.

Potash can be applied to grass land more economically as muriate of potash or as the crude potash salts (kainit, sylvinite, etc.) than as sulphate of potash. The salts of soda, and in some cases of magnesia, which are introduced with the potash in the crude salts, are valuable on grass land; and the potash itself is purchased at a lower unit price than in sulphate of potash. A rough scale of equivalent quantities of potash is:—

1 cwt. sulphate of potash = 1 cwt. muriate of potash.
" " " = 1⅔ cwt. 30-per cent. potash salts.
" " " = 2½ cwt. 20-per cent. French extra kainit.
" " " = 4 cwt. 12½-per cent. kainit.

Prices of Potash Manures.—There have recently been considerable differences in the unit value of potash in the various potash manures now available. These values are obtained by dividing the price of the manure per ton by the percentage of potash contained, and represent the price of one-hundredth part of a ton (22.4 lb.) of pure potash (reckoned as K_2O) when bought in the form in question. Thus muriate of potash containing 50 per cent. of pure potash has recently been quoted at £7 15s. 0d. per ton f.o.r. in London in 2-ton lots for cash. The unit value of potash in this form is therefore $\frac{155}{50}$/=3/1.

When figures obtained in this way are used to compare potash manures in the same class, *i.e.*, containing similar amounts of potash in the same chemical form, they give a useful basis of valuation. The following were average prices in London for the week ending 5th December:—

Manure.	*Potash.* Per cent.	*Price.* Per ton. £ s.	*Cost per Unit in London.* s. d.
Kainit	12½ ...	2 5 ...	3 7
Kainit	14 ,,	2 10 ...	3 7
Sylvinite	20 ...	2 15 ...	2 9
Potash salts	30 ...	3 15 ...	2 6
Potash salts	20 ...	2 12 ...	2 7
Muriate of potash ...	50 ...	7 15 ...	3 1
Sulphate of potash ...	48 ...	10 15 ...	4 6

Certain forms of potash, however, are not interchangeable under all conditions, and in many cases the respective properties of the alternatives should be taken into account as well as their unit prices. For example, 20-per cent. sylvinite is not as safe a manure for potatoes as sulphate of potash, and although it can be purchased at a cheaper unit price this would not be the deciding factor in buying. Some potash manures such as kainit and 20-per cent. sylvinite provide more common salt than those of higher grade and the salt is of value to mangolds and grass. Some, such as ordinary kainit, contain in addition to common salt some sulphate of magnesia which appears to have value under certain conditions.

The following are closely comparable within their sections on all crops and the unit values form a good guide on which to purchase:—

(1) 12½-per cent. kainit and 14-per cent. kainit;

(2) 20-per cent. sylvinite, 20-per cent. potash salts, and 30-per cent. potash salts.

The following are closely comparable for all crops except potatoes and market garden crops:—

(1) 50-per cent. muriate of potash and 48-per cent. sulphate of potash.

The following are roughly comparable within their sections on all crops, the unit values not being the only consideration, but should be regarded in the light of differences in composition between alternatives and of their different effects on special crops:—

(1) 12½-per cent. kainit, 14-per cent. kainit, 20-per cent. sylvinite, 20-per cent. potash salts, and 30-per cent. potash salts.

(2) 48-per cent. sulphate of potash, and 50-per cent. muriate of potash.

Of the lower grade manures it will be noticed that 30-per cent. potash salts are offered at an attractive unit price; and muriate of potash is also cheap and deserves attention in cases where it has been decided not to use sulphate of potash for potatoes, or where a concentrated potash manure is wanted for a mixture for cereals.

The most useful unit values from the farmer's point of view are calculated on the cost of the manures when delivered on the farm. These are obtained by adding to the f.o.r. quotations the approximate charges for carriage and cartage (or to quotations at the farmer's station, the cost of cartage): the price per ton on the farm is then divided by the percentage of the constituent in question.

Basic Slag or Lime?—Farmers often ask whether it is necessary to use lime on their land if the phosphates are supplied as basic slag. Slags contain a small amount of chalk and free lime, and also a larger amount of calcium silicate which has the same effect as chalk in the soil. The quantities of these substances vary in different slags, but the following rough figures calculated as chalk give an idea of what is usually found:—

Present in Basic Slag.	*Equivalent Calculated as Chalk.*
Chalk }	
Quick lime }	5 per cent.
Calcium silicate	45 „ „
Total ...	50 „ „

It will be seen that when slag is used an amount of basic material is left in the soil, which, reckoned as chalk, is equal in weight to about half the slag applied. By far the greater part of this is provided by the calcium silicate contained in the slag. Much arable land which is slightly sour, and carries poor crops in consequence, has a lime requirement of about 30 cwt. of chalk per acre. To sweeten such land by the application of basic slag is quite impracticable. If, for example, in a four-course rotation 6 cwt. of slag is applied to roots and a further 6 cwt. to clover, slag is being given at the rate of 3 cwt., and chalk equivalent at the rate of about 1½ cwt. per acre per annum. Dressings at this rate are not only insufficient to counteract even a slight degree of acidity, but will not supply enough chalk to replace the annual wastage through drainage and the interaction with artificial manures, which is estimated to be at least 5 cwt. of chalk per acre. One of the few advantages of using low-grade basic slags is that, in applying heavy dressings in order to provide the necessary phosphate, correspondingly large amounts of chalk are being restored to the soil.

Liquid Manure.—On farms where there are facilities for collecting liquid manure an application may be given to grass land at this time of the year. The liquid, consisting of the

drainage from cow houses, stables, and manure yards diluted with rain water, is of very variable composition but has considerable manurial value, and its constituents are present in a readily available form.

As an average of 35 samples collected from Scotch farms Hendrick found that 1,000 gallons (4½ tons) of the liquid contained :—

	lb.	*Equivalent to lb.*	*Approximate value.*
Nitrogen (chiefly as ammonium salts)	20	100 Sulphate of ammonia	12s.
Phosphoric acid	3	—	—
Potash	46	3 cwt. Kainit	7s.

Liquid manure is therefore relatively rich in potash and in nitrogen, but poor in phosphate, and against its manurial value of about 19s. per 1,000 gallons must be reckoned the labour involved in applying 4½ tons of liquid to the land. There is little risk of loss in applying liquid manure to grass land in winter. The potash is held in the soil till the plant can use it; while the nitrogen, being largely in the form of ammonium salts, is also held until it is converted into nitrate; when the soil is warm enough for this to occur the grass is also capable of growth and takes up most of the nitrate as it is formed. Liquid manure has given good results on meadow land, whether applied in December or early spring. It is usual to cart out the liquid at intervals during winter and spring as the tanks are filled, giving two or three dressings each of about 1,000 gallons per acre. Results obtained in Ireland, as an average of 54 experiments on the hay crop, show that two applications of liquid manure each of about 2,000 gallons, are as effective in the first crop as a heavy dressing of dung or a light and complete dressing of artificials.

Manures per acre.	*Hay (cwt. per acre).*
No manure	44
16 tons liquid manure (half in February, half in April) ...	60
16 tons dung	61
1 cwt. nitrate of soda	61
2 cwt. superphosphate	
2 cwt. kainit	

Liquid manure is also a valuable dressing for catch crops such as rye, oats and tares, etc., which are required to make quick growth in spring, for since they are usually taken on light

early land these crops respond well to a mixed nitrogenous and potash dressing of a quick acting kind.

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PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	*Average Price per ton during week ending December 5th.*				
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15¼ per cent.)	13.15	13.15	13.10	13. 2	16.11
,, ,, Lime (N. 13 per cent.)	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	13.13*	13.13*	13.13*	13.13*	(N)13. 2
,, ,, ,, neutral (A. 25¾ per cent.)	14.16*	14.16*	14.16*	14.16*	(N)14. 0
Kainit (Pot. 12¼ per cent.)	...	..	...	2. 5	3. 7
,, (Pot. 14 per cent.)	2. 7	2. 6	2.10	2.10	3. 7
Sylvinite (Pot. 20 per cent.)	...	...	...	2.15	2. 9
Potash Salts (Pot. 30 per cent.)	...	..	...	3.15	2. 6
,, ,, (Pot. 20 per cent.)	...	...	...	2.12	2. 7
Muriate of Potash (Pot. 50 per cent.) ...	8. 5	7. 2	8.10	7.15	3. 1
Sulphate of Potash (Pot. 48 per cent.) ...	13.10	...	11.15	10.15	4. 6
Basic Slag (T.P. 35 per cent.)	...	...	...	3.10§	2. 0
,, ,, (T.P. 30 per cent.)	...	...	...	2.17§	1.11
,, ,, (T.P. 26 per cent.)	2.13§	2. 0§	...	...	...
,, ,, (T.P. 24 per cent.)	2. 9§	1.18§	2. 0§	...	...
,, ,, (T.P. 20-22 per cent.)	...	1.13§	..	2. 5§	2. 3
,, ,, (T.P. 18 per cent.)	2. 3§	...	1.15§	...	...
Superphosphate (S.P. 35 per cent.) ...	3.13	...	3. 7§	3. 5	1.10
,, (S.P. 30 per cent.) ...	3. 6	3. 2	3. 0§	3. 0	2. 0
Bone Meal (A. 4¼. T.P. 45 per cent.) ...	9.10	8. 5	9. 0	8. 2	...
Steamed Bone Flour (A. 1. T.P. 60 per cent.)	6. 5	6. 5†	6.10	6. 5	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12.10	...	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Yorkshire; London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

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MONTHLY NOTES ON FEEDING STUFFS.

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Brewery and Distillery By-Products.—In the manufacture of beer, by-products arise which have a distinct feeding value for farm animals, and find a ready sale in most markets.

In beer brewing the barley is soaked in water, germinated and killed. The sprouts that are removed in the process are known as *malt culms*, the residual grain forming the malt of commerce. The malt is then digested in water, the liquid that results being separated from the grain residues, which are dried and form the dried brewers' grains. The liquid is then boiled with hops, cooled, and the hops separated. These *spent hops*, after drying, form the basis of several compound feeding stuffs now on the market. Spent hops, apart from a possible medicinal value, are of no value to the stock feeder. The filtered liquid is now fermented with yeast, cleared and is ready for casking or bottling. The yeast that arises finds its way on the market as brewers' yeast, and is a very valuable feeding stuff.

Malt Culms.—Malt culms contain 20 per cent. digestible crude protein, 12 per cent. of which is true protein, and has a starch value of 43.4. Its nutritive ratio is 1 : 3. A good sample should be dry, light yellow in colour and pleasant smelling. It is a good food for all classes of stock, and is easily digested. Malt culms are generally fed dry to horses, but are best soaked or scalded for other stock. They may be fed up to 6 lb. daily to horses, 3 lb. daily for cows and fattening cattle, up to $\frac{3}{4}$ lb. to sheep, and up to $1\frac{1}{2}$ lb. to pigs. Owing to the tendency of malt culms to become damp and go mouldy, care must be exercised to store them in a dry place.

Brewers' Grains.—Brewers' grains are of value for all classes of stock and can be fed wet or dry. In a wet condition the difficulty of cartage restricts their use to those farms situated near the brewery, except where special provision exists for keeping the grains. By means of cemented pits, and by the use of a little salt, brewers' grains may be kept in excellent condition for months, and pits of this description are in common use in the west country and in some parts of Kent. Dairy cows may be fed up to 80 lb. daily of the wet grains and pigs

DESCRIPTION.	Price per Qr. s.	Price per Qr. lb.	Price per Cwt. s.	Price per Ton. £ s.	Manurial Value per Ton. £ s.	Cost of Food Value per Ton. £ s.	Starch Equiv. per 100 lb.	Price per Unit Starch Equiv. s.	Price per lb. Starch Equiv. d.
Wheat, British	—	—	10/3	10 5	0 16	9 9	71·6	2/8	1·43
Barley, British Feeding	—	—	9/3	9 5	0 12	8 13	71	2/8	1·29
" Canadian No. 4 Western	32/–	400	9/–	9 0	0 12	8 8	71	2/4	1·25
" Persian	30/6	400	8/6	8 10	0 12	7 18	71	2/3	1·20
Oats, English, White	—	—	10/6	10 10	0 14	9 16	59·5	3/4	1·78
" " Black and Grey	—	—	9/–	9 0	0 14	8 6	59·5	2/9	1·47
" Scotch, White	—	—	10/6	10 10	0 14	9 16	59·5	3/4	1·78
" Canadian No. 2 Western	29/9	320	10/5	10 8	0 14	9 14	59·5	3/3	1·74
" " No. 3 "	27/3	"	9/6	9 10	0 14	8 16	59·5	2/11	1·56
" American	24/0	"	8/5	8 8	0 14	7 14	59·5	2/7	1·38
Maize, Argentine	42/–	480	9/10	9 17	0 13	9 4	81	2/3	1·20
" South African	40/6	"	9/5	9 8	0 13	8 15	81	2/2	1·16
Beans, Rangoon	—	—	8/–	8 0	1 12†	6 8	67	1/11	1·03
Peas, English, Maple	—	—	14/6	14 10	1 8	13 2	69	3/10	2·05
" Japanese	—	—	25/0	25 0	1 8	23 12	69	6/10	3·66
Millers' Offals :—									
Bran, British	—	—	—	7 5	1 7	5 18	45	2/7	1·38
" Broad	—	—	—	8 5	1	6 18	45	3/1	1·65
Middlings, Coarse, British	—	—	—	8 10	1 2	7 8	64	2/4	1·25
Meal, Barley	—	—	—	10 5	0 12	9 13	71	2/9	1·47
" Maize	—	—	—	11 0	0 13	10 7	81	2/7	1·38
" " S. African	—	—	—	9 2	0 13†	8 9	81	2/1	1·12
" " Germ	—	—	—	10 10	0 19	9 11	85·3	2/3	1·20
" " Gluten-feed	—	—	—	8 15	1 7	7 8	75·6	1/11	1·03
" Locust Bean	—	—	—	8 10	0 9	8 1	71·4	2/3	1·20
" Bean	—	—	—	12 10	1 12	10 18	67	3/3	1·74
" Fish	—	—	—	20 0	4 6	15 14	53	5/11	3·17
Linseed	—	—	—	23 5	1 11	21 14	119	3/8	1·96
" Cake, English 9% Oil	—	—	—	14 0	1 18	12 2	74	3/3	1·74
Soya Bean Cake 6% Oil	—	—	—	12 0	2 14	9 6	69	2/8	1·43
Cottonseed Cake, English 5½% Oil	—	—	—	8 2	1 15	6 7	42	3/–	1·61
" " Egyptian 5½% Oil	—	—	—	7 17	1 15	6 2	42	2/11	1·56
Decorticated Cotton Seed Meal 7% Oil	—	—	—	13 10	2 14†	10 16	71	3/1	1·65
Coconut Cake 6% Oil	—	—	—	9 10	1 11	7 19	73	2/2	1·16
Palm Kernel Cake 6% Oil	—	—	—	6 12	1 3†	5 9	75	1/5	0·76
Palm Kernal Meal 2% Oil	—	—	—	5 12	1 4	4 8	71·3	1/3	0·67
Feeding Treacle	—	—	—	6 15	0 8	6 7	51	2/6	1·34
Brewers' Grains :—									
Dried Ale	—	—	—	8 2	1 4	6 18	49	2/10	1·52
" Porter	—	—	—	7 12	1 4	6 8	49	2/7	1·38
Wet Ale	—	—	—	1 16	0 9	1 7	15	1/10	0·98
" Porter	—	—	—	1 13	0 9	1 4	15	1/7	0·85
Malt Culms	—	—	—	7 1†	1 14†	5 16	43	2/8	1·43

† At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of November and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 11s. per ton. The food value per ton is therefore £8 9s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 4d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·25d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices :—N, 13s. 2d.; P_2O_5, 4s.; K_2O, 2s. 6d.

may be given up to 2½ lb. per 100 lb. live weight. It is not customary to feed wet grains to other classes of stock than pigs and cows.

Dry brewers' grains, which contain 13 per cent. digestible protein, have a nutritive ratio of 1 : 4 and a starch equivalent of 48.3. With horses, half the oat ration may be replaced by dried grains with advantage, sheep may be given up to 1 lb. daily, and cows and fattening cattle may be given up to 6 lb. daily. Dried grains contain too much fibre to render their use with pigs profitable.

Dried Yeast.—Brewers' yeast in a dried form is a valuable feeding stuff. The wet yeast is dried on rollers, and comes off in the form of reddish brown light flakes. Dried yeast is a protein-rich feeding stuff, and contains 42 per cent. digestible protein, has a nutritive ratio of 1 : 1, and a starch equivalent of 67.2. It is of particular value for young growing stock. Owing to its richness in protein it should never constitute more than 10 per cent. of the total meals or cakes fed in the ration. It is inadvisable to mix it with sugary foods, unless a guarantee has been given that the process of manufacture has resulted in the death of the enzyme which causes fermentation to set up when yeast is added to sugary materials.

FARM VALUES.

CROPS.	Market Value per lb. S.E. d.	Value per unit S.E. s. d.	Starch Equivalent per 100 lb.	Food Value per Ton. £ s.	Manurial Value per Ton. £ s.	Value per Ton on Farm. £ s.
Wheat	1·16	2 2	71·6	7 15	0 16	8 11
Oats	1·16	2 2	59·5	6 9	0 14	7 3
Barley	1·16	2 2	71·0	7 14	0 12	8 6
Potatoes	1·16	2 2	18·0	1 19	0 4	2 3
Swedes	1·16	2 2	7·0	0 15	0 2	0 17
Mangolds	1·16	2 2	6·0	0 13	0 3	0 16
Good Meadow Hay	1·52	2 10	31·0	4 8	0 14	5 2
Good Oat Straw	1·52	2 10	17·0	2 8	0 7	2 15
Good Clover Hay	1·52	2 10	32·0	4 11	1 0	5 11
Vetch and Oat Silage	1·34	2 6	14·0	1 15	0 7	2 2

JANUARY ON THE FARM.

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Agricultural Organiser for Derbyshire.

Weather.—January is usually the coldest month of the year. It has been in this month that the severest frosts have occurred, the Thames having been firmly frozen over on a number of occasions recorded in English history. Likewise the most memorable snowstorms have been experienced in the first few weeks of the year. The temperature of the air and of the top soil is for the greater part of the time below that at which appreciable plant growth can take place, and the duration of bright sunshine is at its minimum—about one-fifth of the figure for May. January is the middle period of what farmers call the dead season, when grass, corn and all other outdoor vegetation are practically at a standstill.

In recent winters the wetness of January weather has been more in evidence than its normal low temperature. In most districts the January rainfall is high compared with that of the next two months, and owing to this, coupled with the little evaporation that takes place at this season, the land usually lies wet and sodden, the arable unfit for tillage operations and the grass land too soft to permit carting on it. Short spells of cold dry weather or black frost are appreciated by farmers, but tradition condemns conditions mild enough to allow the grass to resume growth in this month.

Sowing Wheat and Oats.—November and—to the time of writing—December have not favoured sowing operations, and the area intended for winter cereals has not been completed. After the middle of January wheat seeding may be resumed at the first opportunity when the soil is dry enough. The ordinary winter varieties such as Standard Red and Victor may be sown in preference to spring wheats, but unfortunately there is no experimental evidence on which to base a recommendation of any particular variety for drilling at this time of the year.

The depth of sowing is an important factor affecting the success of corn sown during the colder months. Shallow covering ensures an earlier and thicker plant than is obtained with deep drilling, and the risk of throwing out by frost is reduced rather than increased. Birds often trouble late sowings, especially after the seed has sprouted; but taking all things into consideration it is unadvisable to drill deeper than is necessary just to cover the seed—a depth of about one inch should be aimed at.

Occasionally very good crops are obtained from January sowings. For instance, last year a friend of the writer's drilled Squarehead's Master on 17th January, adopting the advice as to shallow covering. In the previous season the land had grown early potatoes followed by a catch crop of marrow-stem kale. The wheat came well, stooled out thickly and was ready for cutting at the ordinary time; it was estimated at about 6 qr. per acre by the judges of a competition for which the farm was entered. Nevertheless it cannot be contended that January is a good sowing month for most parts of England; in many districts the risk of failure would be high and good results could be obtained only when the season happened to be unusually favourable. The lowest temperature at which wheat will germinate is 37° to 39° F., while the mean temperature in January at a selection of places is:—York 37.9°, Nottingham 37.6°, Cambridge, 37.6°, Llandudno 41.4° and Plymouth 42.2° F. The daily temperature fluctuates about 5° above and below the mean, so that normally growth could be only intermittent at most places during this month.

Only good bold seed should be used for sowing at a time when the food reserves in it are likely to be fully needed; and it is desirable to sow about a bushel per acre more than is necessary in October, not only because of the greater mortality but also because the January sowing has missed the tillering which goes on in the milder weather of October and early November.

It is an accepted principle in farm management that the first chance should be taken. This rule is applied to seeding operations in the old saw "Sow when you can and wait when you must." Accordingly many farmers will take any opportunity which dry weather may afford to sow winter oats this month. Winter oats require about one degree higher temperature for germination than wheat; and in districts where wheat may be sown in January winter oats are not commonly sown till February. In this connection it is perhaps noteworthy that greys are hardier than blacks. As to the hardiness of the whites recently introduced, there is as yet little experimental evidence. In 1922 the writer saw a nice piece which had been sown in January, and last season a fairly good crop which had been sown in February.

Ploughing.—Leas intended to be followed by spring oats are very commonly ploughed in January. Where broadcasting is practised, the lea furrow is turned with a long breast and the

ordinary dimensions of the slice are 8 in. by 5 in. In order that seed may not fall through the bottom of the seams and be lost, the work must be straight and of uniform depth—crooked or wavy slices do not fit together properly but leave crevices—and the furrows must be packed together. Where the ploughing has been well performed, the corn yields fully as well as drilled crops.

Where the corn following "seeds" is to be drilled, the ploughing may be performed more expeditiously with a digger or semi-digger. In this case also, since there is no need to preserve an "arras" or crest to provide covering for the seed, the turf can be better buried; and, where ploughing can be done earlier, the work need not be delayed till after Christmas for fear of the grass growing through the seams.

Corn stubbles still unploughed at this date are in most cases those of the last crop in the rotation and therefore coming green-crop or bare-fallow in 1924: the rules of good husbandry allow of the presence of a reasonable quantity of weeds at this stage in the cropping, as the land will be cleaned before another crop is sown. Stubbles intended to be bare-fallowed in 1924 are better left unploughed for another month or two, as in this case it is undesirable to obtain a frost mould. The stubbles intended for roots should, of course, be turned over as soon as practicable.

In dealing with a twitchy piece of land, particularly where the weedy growth is confined to the top few inches, there are, at this time of the year, two alternatives:—(1) To plough shallow, leaving the weeds near the surface with a view to their easier eradication in spring before a second and deeper ploughing; (2) To plough deeply, using a digger and large skim coulter, burying the weedy layer in the hope of killing and rotting it. The choice will be determined by conditions. On fairly heavy land the second method is preferable, partly because on heavy soils a second ploughing late in spring should be avoided, and partly because this class of work really does kill twitch on heavy land, provided that the ploughing is efficient in the matter of placing the weeds out of reach of light and air. On lighter land the second method would not be good, because the weeds would grow through the deepened layer and then be more difficult to extract. Also in this case a second ploughing does not hopelessly destroy the tilth: where moisture conditions will not allow of a second ploughing in

spring, the necessary depth of tilth can on light land be obtained by successive operations with the cultivator or spring tooth harrow.

Boxing Seed of Late Potatoes.—Second early and late varieties if not already bought should be ordered now, and the former should certainly be boxed by the end of the month. As regards late potatoes, boxing is not the rule, although it would seem that there is a good case for the extension of the practice. Timely boxing usually increases the yield of ware by about 1½ tons per acre; and, as "rogues" and "duds" are shown up by their sprouts or by the absence thereof, the crop planted with sprouted seed can be purer and more regular than it might otherwise be. Where planting was necessarily late, the advantage of proper and timely boxing might be 2½ tons per acre. On the other hand, with early planting, seed taken direct from the pit may yield almost as well as boxed seed. The virtue of boxing is not confined to the preservation of the first sprout; apparently the wilting of the setts in the boxes is advantageous.

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Clean Milk Production.

ONE of the chief characteristics of the London Dairy Show last October was the great display of special utensils and machinery designed to help in the production of Certified and other designated milk. The view held by many authorities that such milk is to be the milk of the future received support from the fact that in the Main Hall of the Show in a very prominent position there was a Stand under the joint auspices of the Ministry of Agriculture, the British Dairy Farmers' Association and the National Institute for Research in Dairying, Reading. At this Stand three demonstrations were given daily with the object of showing not only to producers, but also to the general public, how Certified Milk is produced.

In England alone there are at present nearly 150 producers of Certified, Grade-A (Tuberculin-tested) and Grade-A milk. This number is gradually increasing and it is hoped that in course of time there will be available an ample supply of the very cleanest of raw milk. Farmers will produce it if the public demands it. Greater care, and incidentally greater expense, are needed for its production than for ordinary milk, and hence its cost to the consumer is somewhat higher, but since such milk will keep sweet, even in the hottest of weather, for a long period, it is in the end the cheapest milk to buy.

The Stand was divided into three sections. One section was allotted to two cows, the next represented the room where the washing and sterilising of utensils takes place, and the third where the milk is cooled and bottled. At each demonstration the essentials of clean milk production were carefully explained.

Special buildings and stall fittings are sometimes an advantage, but cleanliness in all things must be the watchword; without cleanliness Certified Milk cannot be produced. The cow must be both clean and healthy, and the cowshed clean, well ventilated and well lighted, for sunlight kills germs. The flanks and udder of each cow should first be washed and then wiped with a clean cloth. The milkers must be scrupulously clean; they must wash their hands before milking and milk with dry hands. A great advantage is the use of a Davis or similar small-mouthed milking pail, into which dust is less liable to fall than into the ordinary pail. Immediately after milking the milk should be removed from the cowshed to the dairy, and there strained and cooled to as low a temperature as possible. It should then be run into bottles, which have previously been sterilised; these should then be capped and sealed and kept in a cool room. All utensils must be carefully washed and then sterilised. They should be sterilised again immediately before use.

While all this was being carefully explained by the Demonstrator, the cows were milked, and the milk strained, cooled, and bottled, as would be done on a certified milk farm. Both the milker and dairymaid wore white overalls.

The growing popularity of this kind of milk was evidenced by the crowds that assembled in front of the Stand, some time before each demonstration was timed to take place. In the intervals, too, the demonstrator and his assistants, as well as the Ministry's representative, were assailed with questions dealing with the problems of producing Certified Milk.

This is a phase of dairy farming that has come to stay, and it is to be hoped that it will lead to a greater consumption of milk, especially by children. This, in turn, will improve the national health for, taking bulk for bulk, no other drink in the world contains so much nourishment as is to be found in milk.

Short Course in Clean Milk Production.

A course of instruction in the production and handling of milk will be held at University College, Reading, from Wednesday, 30th January, to Saturday, 23rd February, 1924. The course is intended primarily for dairy instructors and instructresses, but other students will be admitted if the limited accommodation (24) will allow. Applications for admission to the course should be made in the first instance to the Dean, Faculty of Agriculture and Horticulture, University College, Reading, and intending students should be prepared to commence work at 9.0 a.m. on Wednesday, 30th January.

The fee for tuition for the three weeks will be £5, which must be paid to the College Office.

Lectures will be given on milk production and supply, chemical composition of milk, and diseases of cattle affecting milk supply; and demonstrations of practical bacteriology in connection with the handling of milk will be arranged. Excursions will be arranged to well-known dairy farms, factories and depôts, but the travelling expenses in connection therewith are not included in the tuition fee.

The College cannot undertake to arrange residence for students, but will give all possible assistance and advice thereon. Students are advised to take bicycles with them.

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Insect Pest Control.

Curiosity has been expressed as to a recent notice in the Press referring to a consignment of earwigs sent from this country to New Zealand to destroy bacteria. Such a statement would probably fill the residents of New Zealand with misgiving, as the earwig is already a pest there to an extent unknown in this country. The truth is that the recent consignment to New Zealand consisted of the puparia of *parasites* of the earwig, and in some cases the earwigs themselves with the parasites inside them. These earwig parasites do not occur in New Zealand, and it is hoped that they will increase and multiply there at the earwigs' expense and so form a natural control of that pest. The earwig itself, being an insect which has been accidentally introduced into New Zealand, possesses no natural enemies sufficient to keep it in check and maintain a balance. Hence the need for the measures which are here outlined.

The earwig parasites are being bred and despatched to New Zealand by the Rothamsted Experimental Station, acting on

behalf of the Imperial Bureau of Entomology. This Institution is also breeding Ichneumon Fly parasites of the Pear Slug-worm for introduction into New Zealand.

Great Britain is receiving her share in the exchange of beneficial insects between countries. From a small amount of material received from France last spring, some thousands of cocoons of a Chalcid Fly known as *Aphelinus mali* have been raised at the Ministry of Agriculture's Pathological Laboratory at Harpenden for distribution to a few chosen places over the country next year, which will become distributing centres in their turn. This Chalcid Fly is a parasite of the Woolly Aphis or American Blight, against which, if it can be successfully established, it should prove a valuable controlling agent. The Fly was at first thought to confine its attentions entirely to Woolly Aphis, but from information recently received from other countries where its introduction has been accomplished, some other kinds of "greenfly" or aphides are falling a victim to it—a point which may add to its usefulness.

It is practically impossible to increase artificially the numbers of a beneficial insect which is either indigenous to, or has been long established in, this country, as its position in the insect world is stabilised; hence the reliance on new introductions. Our ladybirds are instances of very beneficial insects, which, however desirable it may be to increase them by artificial means, offer little hope of an attempt to do so being successful.

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The London Thoroughbred Stallion Show for 1924.

THE Ministry of Agriculture and Fisheries (acting on behalf of the War Office) gives notice that a Show of Thoroughbred Stallions will be held, in conjunction with the Hunters' Improvement and National Light Horse Breeding Society, at the Royal Agricultural Hall, Islington, on March 4th, 5th and 6th, 1924.

A Challenge Cup presented by H.M. The King will be awarded for the Champion Stallion in the Show; and a Gold Medal will be awarded by the Ministry to the owner. Sixty King's Premiums (including twelve Super-Premiums) will also be offered for award by the Ministry.

In addition to the King's Premiums, a very limited number of War Office Premiums will be available for award on the recommendation of the County Horse Breeding Committees.

These awards will not be made, however, until the routes of the King's Premium stallions have been arranged.

Copies of the Regulations governing the award of the Premiums can be had on application to the Ministry.

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Lantern Slides on Poultry Subjects.

THE Ministry has arranged for the collection of a set of lantern slides on poultry subjects for the use of county poultry instructors and others engaged in lecturing on poultry-keeping. Some 120 of the most important slides have already been made, and the series will be added to as opportunity occurs for securing suitable subjects.

Any of the slides can be obtained at 10d. each, and a list of the subjects illustrated will be sent to any poultry instructor desiring to purchase them. Explanatory notes in connection with these slides are being prepared by the Ministry and will be issued as soon as completed.

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Foot-and-Mouth Disease.—All restrictions imposed in connection with the outbreaks at Morden, Surrey; Dean, Beds; Withernsea and Bridlington, Yorks, have been withdrawn.

The areas in Bucks and Kent to which restrictions were applied on account of the outbreaks near Wendover and Birchington respectively have been contracted.

Statement as to the number of outbreaks of foot-and-mouth disease from 17th November to 12th December (inclusive).

Counties.		*Counties.*	
England and Wales.		Salop	33
Buckingham	1	Stafford	10
Chester	409	Warwick	3
Denbigh	30	Worcester	10
Derby	5	Yorks, N.R.	5
Durham	71	Yorks, W.R.	23
Flint	13	*Scotland.*	
Gloucester	30	Aberdeen	3
Kent	1	Ayr	3
Lancaster	17	Dumbarton	16
Leicester	7	Kinross	1
Lincs, Lindsey	1	Lanark	10
Monmouth	1	Perth	2
Northumberland	45	Renfrew	10
Nottingham	1	Stirling	5
		Total	766

General Restrictions.—Until the 22nd November, on which date the Ministry learnt of the infection of the Newcastle loading docks and market, the Ministry pursued its usual policy of imposing restrictions over a radius of 15 miles from any new centre, with extensions in the case of those centres in which the disease had spread. The danger of a widespread infection resulting from the infection at Newcastle rendered more drastic measures necessary, and on that date the Ministry made an Order entirely prohibiting the movement of stock into, within or through, a large area stretching from the Clyde to Thames and Severn, but excluding Wales. This Order was quickly modified so as to provide for necessary movements of animals by licence, and the holding of fat stock markets with veterinary inspection, the main objects being (a) to stop entirely all store stock markets, and (b) to prevent general long distance movements except under control.

On 1st December this Order was replaced by a new Order, the Great Britain (Foot-and-Mouth Disease) Order of 1923 (No. 5), which revoked all the existing Orders except the Scottish Orders and the North Midlands (Cheshire group) Orders, and divided the area to which restrictions were applied on the 22nd November into (a) 11 infected areas surrounding the actual centres of disease, and (b) a controlled area comprising the remainder of the district subject to the Great Britain Order.

Provision was made in this new Order for the movement by licence of the Local Authority into and within these areas of store as well as fat stock to supply the needs of the population and of the farmers, but no movement was allowed out of the infected areas. Markets and sales were, as before, confined to fat stock intended for immediate slaughter and to displenishing sales of animals on farm premises. No licence was permitted to be granted under the Orders for any movement within two miles of an infected place and no fat stock market was allowed to be held within 5 miles of infected premises. Subsequently movement of fat stock only was permitted from one Infected Area to a slaughterhouse in another Infected Area.

In view of the freedom of the greater part of the Controlled Area from outbreaks of the disease, it was decided to remove all restrictions therefrom as from the 15th December.

Imported Animals.—It was also considered desirable as a precautionary measure to prevent the risk of the spread of disease from store markets by the movement of imported animals from market to market to provide that no licence shall be granted for the movement of imported animals direct to an authorised market from a landing place, but only (1) direct to a slaughterhouse or (2) direct to private premises for detention thereon for a period of fourteen days, instead of for the period of six days prescribed by the previously existing Orders. This was effected by the Imported Animals Order of 1923, which came into force on the 19th November.

Summary.—The number of outbreaks from the period 27th August to the 12th December now totals 1,074, affecting 28 counties in England, 2 in Wales, and 9 in Scotland.

The numbers of animals slaughtered, or authorised to be slaughtered, to 12th December were 35,323 Cattle, 16,283 Sheep, 19,448 Pigs and 31 Goats.

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AGRICULTURAL RETURNS OF ENGLAND AND WALES, 1923.

PRODUCE OF CROPS.

The following PRELIMINARY STATEMENT issued on 24th November last shows the estimated total produce and yield per acre of the POTATO and ROOT CROPS in England and Wales in 1923, with comparisons for 1922, and the average yield per acre of the ten years 1913-1922.

Crops.	Estimated Total Produce.		Acreage.		Estimated Yield per Acre.		Average of the Ten Years 1913-22.
	1923.	1922.	1923.	1922.	1923	1922.	
	Tons.	*Tons.*	*Acres.*	*Acres.*	*Tons.*	*Tons.*	*Tons.*
Potatoes -	2,756,000	4,012,000	466,853	561,177	5·9	7·1	6·2
Turnips & Swedes -	10,828,000	10,908,000	858,429	819,686	12·6	13·3	12·4
Mangolds -	6,956,000	8,560,000	401,447	421,388	17·3	20·3	18·9

Potatoes.—Potato planting was rather late in 1923 as spring work generally had been delayed by rainy weather and the difficulty in working heavy land. Planting was done with the soil cold and the crop came up slowly, whilst earlies were cut by May frosts in most parts of the country. The weather early in the season was not very favourable to growth, but the rains of August and September were beneficial. In the north-west and in Wales, however, the continuous autumn rains caused many tubers to rot before lifting. Most of the crop has been stored in dirty condition, but the quality is fairly good as a rule, though the tubers are small. The total production of potatoes on agricultural holdings in England and Wales is estimated at 2,756,000 tons, as compared with 4,012,000 tons last year, and 2,958,000 tons in the very dry year 1921. The average yield per acre is estimated at 5·9 tons, or 1¼ tons less than the very high figure of last year, and one-third of a ton below the average of the ten years, 1913–22. Yields are below average in most counties, but of the chief potato-growing districts Lancashire has the most unsatisfactory crops, the yield in that county being one ton below average. In the Holland division of Lincolnshire and in the Isle of Ely yields were only one-fifth of a ton below average.

Turnips and Swedes.—The dry spell of weather in June and July, which was experienced in most parts of the country, had a bad effect on turnips and swedes. Sowings of turnips were delayed in many districts and plants of swedes and turnips were often patchy, while in a few districts there were many complete failures. In the north conditions were more favourable and a good plant was obtained. Very fair growth was made in the late summer and autumn, but in the eastern and midland counties swedes suffered from mildew. The average yield over the whole country is estimated at 12·6 tons per acre, which is three-fourths of a ton less than last year, but one-fifth of a ton above average. Crops are well over average in the north, and poorest in Oxford, Essex and West Suffolk, where there were many complete failures. The estimated total production of 10,828,000 tons is very little less than last year, the acreage having been increased.

Mangolds.—The sowing of mangolds was late owing to the land requiring much work to obtain a satisfactory seed bed, and germination, though usually regular, was slow. After coming through, the plant remained almost at a standstill for some weeks, as a result of the cold weather, and continued backward throughout the season, so that the roots are small. An unusually large proportion ran to seed. Yields are light in all parts of the country, but are relatively poorest in the north and south-west. The average yield per acre over the whole country is estimated at 17·3 tons, or 1¾ tons under average, and 3 tons less than last year, whilst the estimated total production, 6,956,000 tons, compares with 8,560,000 tons in 1922, and 7,583,000 tons the average of the ten years, 1913–22.

In most districts supplies of winter keep for live stock will be sufficient, any shortage of roots being counterbalanced by the large stocks of hay. In the hill districts of Wales and the north-west of England the position is not satisfactory, as in these areas supplies of hay are short, much of the crop being spoiled by the wet weather and large areas were never cut.

Dairy Exhibition at Milan.—A notice was issued in October last, that an exhibition under the auspices of the Italian Government would take place in Milan in November. The Exhibition was to include all the products of milk, and types of machines, utensils and other articles used in connection with the dairy industry.

The Ministry of Agriculture is informed that the Exhibition has been postponed until April, 1924. The postponement is due in part to the desire of American exhibitors, who were recently occupied with a similar Exhibition at Washington, to be represented at the Milan Exhibition.

British firms who may wish to participate should address their inquiries and applications to the Directzione Generale, Via Tigli 7, Milan, Italy.

Agricultural Machinery Exhibition, Brussels, 1924.—The eleventh agricultural machinery exhibition organised by the Société de Mécanique et d'Industries Agricoles will be held at Brussels from 16th to 25th February, 1924.

The exhibition will include cultivating, harvesting and food-preparing machinery; milking machines and dairy equipment; land improvement machinery, *i.e.*, drainage, levelling and clearing; forestry appliances; equipment for rural industries; tractors and other agricultural engines and accessories; rural building materials and architecture; small tools and harness; and the application of electricity to the farm.

Fictitious Claims for Fertilisers.—A certain amount of interest has recently been aroused by the report of a discovery in France of a new fertiliser, applicable to both cereals and roots, for which results bordering on the marvellous are claimed. The process, according to reports, consists in steeping the seeds before sowing in a solution, the composition of which is not revealed; and it has been stated that the process has been approved by the French Government. This statement is entirely without foundation. The French Ministry of Agriculture has recently issued a note warning farmers and others interested in agriculture to be on their guard against claims of this nature. It points out that the common sense of agriculturists has generally stood them in good stead in estimating the value of advertisements, while they

may always, if any doubt arises, seek the advice of Research Institutes, or of the local advisory centres. The warning thus addressed to French farmers is passed on in the same terms to farmers in this country.

International Dairy Exhibition in Argentina.—An International Dairy and Refrigerating Machinery Exhibition will be held at Buenos Aires in May, 1924, organised by the Argentine Department of Agriculture. Space will be free of charge to exhibitors, and all machinery, implements and general merchandise for exhibition will be free of customs, entries or fees, but exhibitors must arrange their own fixtures and equipment. A copy of the prospectus may be seen at the offices of this Ministry.

The Commercial Secretary to H.M. Legation at Buenos Aires reports to the Department of Overseas Trade that these exhibitions are successful from the local exhibitor's point of view, as they provide useful propaganda at a moderate cost. He considers that there is justification in encouraging British manufacturers to take part when they have local importers or representatives who carry local stocks of suitable machinery and implements which are available for exhibition, or to whom they are prepared to ship suitable specimens for the purpose, and when the importer or representative recommends participation.

Import Regulations as to Plants, Potatoes and Tomatoes from France.—The Ministry has issued an amended Order (The Colorado Beetle Order of 1923) in place of the Order which was made in 1922, with the object of preventing the introduction of this pest from France.

The effect of this new Order is that in place of the declaration formerly required, each consignment of living plants, potatoes or tomatoes shipped from ports in European France to this country must be accompanied by the undermentioned certificate or copy certificates :—

(1) *If grown in France.* (a) For potatoes and for all plants which are subject to the Destructive Insects and Pests Order of 1922, the copy certificates required under that Order. These certificates must be officially endorsed to the effect that the produce was not grown in the neighbourhood of those districts where the Colorado Beetle has existed.

(b) For tomatoes and for plants which are not subject to the Destructive Insects and Pests Order of 1922, an official certificate to the effect that the produce was not grown in the neighbourhood of those districts where Colorado Beetle has existed.

(2) *If grown in other countries and shipped from European French Ports.*—Either the copy certificates required under the Destructive Insects and Pests Order of 1922, or a certificate of origin visé by a Local Authority in the country of origin ; the country and place where the produce was grown must be stated in the certificates.

The certificate or copy certificate must be delivered to an Officer of Customs at the same time as the entry relating to the consignment. In the event of failure to produce the necessary document, a consignment must be destroyed or re-exported by and at the expense of the importer unless its disposal is otherwise authorised by the Ministry.

No certificate or declaration of any kind is now required in the case of vegetables for consumption other than potatoes or tomatoes. The Order came into operation on the 17th December, 1923.

Importation of Plants into Canada.—Nurserymen and others interested in the trade in plants to Canada are doubtless aware that nursery stock may only be imported into that Dominion under permit issued by the Dominion Government. These Permits are issued to the Importers in Canada, and the Ministry is informed that it is unnecessary that a permit be forwarded to this country for return with the consignment to which it relates. The Canadian importer should, however, notify the English exporter of the number of the relative permit and this number should be marked on each container. By adopting this course the entry of consignments into the Dominion will be facilitated.

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REPLIES TO CORRESPONDENTS.

Algerian Phosphate for Wheat.—J.K. asks for information as to the value of ground Algerian phosphate applied to wheat at the rate of 5 cwt. per acre a fortnight before sowing.

Reply: As the phosphate in Algerian phosphate is not soluble in water it could not necessarily be depended on to become available in a sufficiently short time to be of much benefit to the crop. Its availability would be enhanced (1) by extra fineness of grinding; (2) if there were a heavy rainfall; and (3) if the soil were sour. This last condition, however, would be adverse to wheat. Leaflet No. 80 expresses a distinct preference for superphosphate for corn crops, and 3 cwt. of superphosphate would probably prove both cheaper and more effective.

Cowpeas.—L.M. asks whether cowpeas have been tried in England.

Reply: There is no information available as to any actual trials. It is not probable that the crop would succeed in this country.

Thermo-Gen System of Paper Mulching.—N.O. asks for information.

Reply: The method of using paper for mulching, as practised in Honolulu, is described in the Queensland Agricultural Journal, Vol. XVIII, p. 293 (October, 1922), and in the Indian Scientific Agriculturist, Vol. IV, p. 186 (May, 1923). From the former it is gathered that the system has been patented, from the latter, that "Pabco Thermo-Gen is an asphalt-impregnated felt." So far as can be ascertained the system has not been tried in this country.

Plants for Hedges.—P.Q. asks for suitable quick-growing plants for hedges.

Reply: Thorn would be suitable if a quick-growing hedge to keep out cattle is required. If an evergreen hedge is needed, privet (*Ligustrum ovalifolium*) should be planted. *Berberis stenophylla* would be suitable if an evergreen flowering hedge is required.

Analyses of Cooked and Raw Potatoes.—R.S. asks whether the figures given in the Ministry's Miscellaneous Publication No. 32 refer to raw or cooked potatoes.

Reply: They refer to raw potatoes. Similar figures for cooked potatoes are not available, but no serious error will result if the figures for raw potatoes

are used. The figures given for roots refer, in every case, to roots in the raw state.

Pig-Feeding in Denmark.—T.U. asks for information.

Reply: The Ministry does not know of any book in English which would give the information. Methods of feeding generally adopted in Denmark apparently vary according to circumstances, but skimmed milk or whey, a supply of which is afforded by the dairying industry, seems always, or practically always, to form part of the ration. As regards the feeding at the Experimental Stations for Pigs the information in the note below, taken from the 9th and 11th reports of these stations, was enclosed :—

Pig Feeding at Danish Breeding Centres.

Bregentved, 1*st September*, 1916—31*st August*, 1917.—Concentrated food, first half-year, barley and maize, half of each; the small pigs got only barley. In the second half-year, owing to shortness of supplies, no barley was available, and about ¾ maize and ¼ coconut cake was used. As liquid food only skimmed milk was used up to 4·5 kilo. (say 10 lb. or 1 gallon) per pig per day. If this amount was not enough to moisten the concentrated food water was added so as to preserve a proportion between solid and wet food of 1 : 2. A little bone meal was also given. The small pigs are given their concentrated food dry (finely crushed); later they go on to wet food. The pigs are given as much as they will eat, but they must eat readily. If a pen leaves its food, it has to go without for one or two feeding times.

Bregentved, 1*st September*, 1921—31*st August*, 1922.—Much the same as above. Small pigs under 30 kilo. (say 66 lb.) only get barley. Skimmed milk reduced to 3 kilo. (say ¾ gall.)

Elsesminde, 1*st September*, 1916—31*st August*, 1917.—Less milk was given to the older pigs, but all got the same proportion—1 concentrated food to 2·6 skimmed milk or skimmed milk and water. In the case of the big pigs in Class IV, receiving 3 kilo. food units* or over daily, the liquid food remained always the same (5·4 kilo. daily of equal proportions of skimmed milk and water) and the weekly increase was given in the form of concentrated food.

Percentage Composition of Food.

	Food calculated in Food Units.	
	Concentrated.	*Skimmed Milk.*
	p. c.	p. c.
Class I Under 25 kg. (55 lb.)	70 ...	30
„ II From 25–40 kg. (55–88 lb.) ...	75 ...	25
„ III From 40–55 kg. (88–121) ...	80 ...	20
„ IV Over 55 kg. (121 lb.)	85 ...	15

The food is mixed and allowed to stand about 24 hours before feeding. About 25–50 grammes (0·8-1·6 oz.) of bone meal per pig per day.

Elsesminde, 1*st September*, 1921—31*st August*, 1922.—More or less as above. But the classes in the table are slightly different, the food proportions not being altered. Class II from 25 to 45 kilo.; Class III from 45–65 kilo.; Class IV over 65 kilo.

It is noted that the pigs must clear up all the food at each feeding time:—6 a.m., 11.30 a.m. and 5.30 p.m

Over Lojstrup (*Jutland*), 1*st September*, 1916—31*st August*, 1917.—The food in previous years consisted of skimmed milk and of equal parts of barley

* A kilogramme food unit is the equivalent of 1 kilog. (2·2 lb.) of barley.

and maize; this year both milk and barley were short. To avoid giving nothing but maize, coconut cake was used (80 p. c. maize and 20 p. c. coconut cake).

Coconut cake in other trials had been shown to have a favourable effect on the firmness of the flesh, and so counteracted the maize. The young pigs did rather badly on a diet including too much maize.

Over Lojstrup (Jutland), 1st September, 1921—31st August, 1922.—No special notes on the feeding for this year are given. The following paragraph, however, occurs:—The shortness of the harvest of 1921 had the effect that the pigs suffered somewhat from want of bedding; added to this was the severe period of frost in January and February. The result was that the pigs suffered from cramp; as soon as this appeared all the pigs in the station were given a dose of "phosphoric oil"; this was so effective that scarcely a single pig suffered any lasting result from the complaint.

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NOTICES OF BOOKS.

International Year Book of Agricultural Statistics.—(*Copies can be obtained direct from the International Institute of Agriculture, Rome; or from the Ministry of Agriculture, 10, Whitehall Place, London, S.W.1., price 8s. post free.*)—The International Institute of Agriculture at Rome has recently issued the "International Year Book of Agricultural Statistics, 1922." Various changes have been made in the volume consequent on a decision to make it a regular annual publication, the previous issues having appeared at longer intervals. Figures are given for the years 1922, 1921, 1920 and 1919, and instead of the averages for the years 1914-1918, those for the years 1909-13 have been substituted, as affording a more satisfactory basis of comparison than the figures of the war period. The volume includes data showing for each country—(1) area and population; (2) acreage, production and yield of the principal crops; (3) number of live stock; (4) imports and exports of the various agricultural products; (5) prices of agricultural products; (6) freight of cereals and cotton; and (7) production of fertilisers.

Insecticides, Fungicides and Appliances.—(O. G. Anderson and F. C. Roth. London: Chapman and Hall. 15s. net.) The first 175 pages of this book are devoted to a series of laboratory exercises for students taking a course in insecticides and fungicides at an American Agricultural College. They will hardly prove of interest to English growers, except perhaps as evidence of the thorough manner in which the subject of pest control is approached in the United States.

The last 175 pages are given to a general discussion of spraying and spray appliances, which should prove useful to those who are following the development of the subject in the United States, especially perhaps to any who may be tempted to test American methods under English conditions. Fruit-growing periodicals from across the Atlantic are now widely read in England and the glowing accounts published of new methods are apt to be misleading to those accustomed to the sober phraseology of the English Press. The present book carefully avoids such misplaced enthusiasm. For instance, those testing the spray gun on low power outfits will be interested in the

statement (p, 239) that an engine of at least 3½ h.p. is necessary to operate one gun, while for two guns, 10 h.p. is desirable, since the minimum working pressure is 250lb. And again, as regards dusting (p. 300):—"The prevalence of dusting among fruit growers in the State of New York varies from ⅛ of 1 per cent. to 5 per cent. . . Probably the dusting of fruit is more prevalent in New York than in other portions of the United States. . . . .

"Dusting is still in the developmental stage and with continued improvement in materials and equipment may have greater possibilities in the future than at present. Present indications are that the future possibilities for dusting may be somewhat greater for low-growing crops than for tall trees."

The book is published by John Wiley & Sons of New York and may be obtained from Messrs. Chapman & Hall, Henrietta Street, at a price of 15s.

Successful Spraying, and How to achieve it.—(P. J. Fryer, F.C.S., F.I.C. London: Ernest Benn, Ltd., 1923, 154 pp., 7s. 6d. net.) This is a handbook for growers, nurserymen, horticulturists, gardeners and amateurs, dealing chiefly with a consideration of the insect pests and fungus diseases of fruit trees and their control.

The author describes the principles of "Contact" sprays for sucking insects and "Stomach poisons" for biting insects.

"Wetting" agents, water properties and the chemistry of spraying are also considered.

A description is given of the more modern hand and power spraying appliances, a short chapter on fumigation, and the work concludes with a summary of the chief insect pests and fungus diseases of fruit trees and small fruit, with suggestions for their individual control.

The book is illustrated with a number of photographs and text figures.

Die Lupine als Objekt der Pflanzenforschung.—(F. Boas and F. Merkenschlager. Berlin: Paul Parey, 1923. 144 pp. 63 illustrations.) This book has a manifold object. It takes the lupin as a text for a description of the processes which take place in the life of a plant, in much the same way as Dr. D. H. Scott used the wallflower in Part I of "Structural Botany." The monograph is also designed to satisfy the increasing interest with which the plant is being regarded by the farmer. In this latter connection there are chapters on the lupin as a collector of nitrogen and carbon dioxide, its use as a soil improver, and its economic value. Copious references and a full index enhance the value of the volume.

Le Soja et son Lait végétal.—(L. Rouest. Carcassonne and Paris, Librairie des Sciences Agricoles, 1921. 157 pp., 8 illustrations, 10 francs.) Whether the cultivation of the soya bean for its seed in this country will ever, under normal climatic conditions, become a possibility is extremely doubtful. Those, however, who wish to attempt to find a successful solution to the problem will gain a considerable amount of assistance from this small volume, which gives an account of the work that has been done in France in this direction.

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ADDITIONS TO THE LIBRARY.

Dairying.

Canada Department of Agriculture.—Bulletin 34 (New Series) :—Dairying in New Zealand and Australia. (33 pp.) Ottawa, 1923. [63.7(9).]

Texas Agricultural Experiment Station.—Circular 30 :—The Practicability of the Milking Machine. (23 pp.) Brazos County, 1923. [63.713.]

Nebraska Agricultural Experimental Station.—Bulletin 181 :—Growth Studies of Dairy Heifers II. Protein Requirements for Growing Heifers. (18 pp.) Lincoln, 1923. [63.711(04).]

Poultry.

Roberts, H. A.—Commercial Poultry Raising. (607 pp.) London : Chapman & Hall, 1923, 15s. net. [63.65(02).]

Evans, E.—The Biology of the Fowl. (160 pp.) The Author, 21, Rydal St., Burnley, 1923, 7s. [63.651(02).]

Hardy, F. W.—The Chemistry of Food : A Manual for Poultry Keepers. (47 pp.) London : National Utility Poultry Society, 1923, 2s. [612.394; 63.65 : 043.]

Engineering.

Cleghorne, W. S. H.—Farm Buildings and Building Construction in South Africa. Second Edition. (360 pp.) London : Longmans, Green & Co., 1922, 25s. [69(02).]

Purvis, G. H.—Agricultural Implements. (115 pp.) [Successful Farming Series.] London : Ernest Benn, Ltd., 1923, 2s. 6d. [63.17(04).]

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Pigou, A. C.—Essays in Applied Economics. (200 pp.) London : P. S. King, 1923, 10s. 6d. net. [33(02).]

Gardiner, R. S., Central Land Owners' Association.—The Agricultural Landowners' Handbook on Taxes, Rates and Tithe. (110 pp.) London : Estates Gazette, 1923, 3s. net. [336.22; 348.]

Institute International d'Agriculture.—Reglementation des Prix de vente des Produits agricoles. (79 pp.) Rome, 1923, Fr. 5. [338.5; 338.99.]

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The Periodicity of Meteorological Factors in Relation to Agriculture, *F. Eredia.* (Int. Rev. Sci. & Pract. Agr., 1923, No. 3, pp. 587-594.) [551.5.]

Danish Experiments in Plant Culture and details about the Trade in Controlled Danish Seed. (Tidsskr. Planteavl, XXIX (1923), 4, pp. 667-672.) [575.4; 63.1951.]

Investigations on the Solubility of Various Phosphates, *H. R. Christensen.* (Tidsskr. Planteavl, XXIX (1923), 4 pp. 513-574.) [63.1672.]

Nitrates and Ammonia from Atmospheric Nitrogen, *E. K. Scott.* (Jour. Roy. Soc. Arts, Nov., 1923, pp. 859-895.) [668.6.]

Field Crops.

The Growing of Crops for Silage and some Experimental Results, *J. P. Drew.* (Jour. Dept. Agr. Ireland, XXIII, 2, Aug., 1923, pp. 144-157.) [63.19832.]

A Study of Factors Affecting the Nitrogen Content of Wheat and of the Changes that Occur during the Development of Wheat, *G. A. Olson.* (Jour. Agr. Res., XXIV, 11, June 16, 1923, pp. 939-953.) [63.311.]

The Water Content of Barley Kernels during Growth and Maturation, *H. V. Harlan* and *N. P. Merrett.* (Jour. Agr. Res., XXIII (1923), pp. 333-360.) [63.313.]

Further Studies on Seed Potato Treatment, *J. C. Gilman* and *J. E. Melhus.* (Phytopath, XIII (1923), 8, pp. 341-358.) [63.512.]

Horticulture.

Commercial Horticulture in Scotland, *D. V. Howell.* (Scottish Jour. Agr., VI, 4, Oct., 1923, pp. 402-413.) [63.5(41).]

Plant Diseases.

Silver Leaf Disease, IV, *F. T. Brooks* and *H. H. Storey*. (Jour. Pomology and Hort. Sci., III, 3, Sept., 1923, pp. 117-141.) [63.24.]

Red Plant in Strawberries and its Correlation with "Cauliflower Disease," *E. Ballard* and *G. S. Peren*. (Jour. Pomology and Hort. Sci., III, 3, Sept., 1923, pp. 142-147, figs. 36-42.) [63.24.]

On the Cause of Rolling in Potato Foliage; and on some Further Insect Carriers of the Leaf-Roll Disease, *P. A. Murphy* (Sci. Proc. Roy. Dublin Soc., XVII, 20, June, 1923, pp. 163-184.) [63.21.]

Transmission, Variation and Control of Certain Degeneration Diseases of Irish Potatoes, *E. S. Schultz* and *D. Folsom*. (Jour. Agr. Res. XXV, 2, July, 1923, pp. 43-118, plates 1-15.) [63.23.]

Fusarium Blight of the Cereal Crops, *D. Atanasoff*. (Wageningen Land. bouwhoogeschool Med., XXVII (1923), 4, pp. 1-132, plates 1-6.) [63 24.31.]

Injury to Foliage by Arsenical Spray Mixtures, *D. B. Swingle* and *H. E. Morris*. (Jour. Agr. Res., XXIV, 6, May, 1923, pp. 501-537.) [63-295.]

Live Stock.

The Irish Live Stock Industry, *D. Twomey*. (Jour. Dept. Agr. Ireland, XXIII, 2, Aug., 1923, pp. 125-143.) [63.6(415).]

The Value of Blood Meal as a Pig Food, *E. J. Sheehy*. (Jour. Dept. Agr. Ireland, XXIII, 2, Aug., 1923, pp. 169-183.) ([63.60432; 63.64 : 043.]

White versus Yellow Maize as a Pig and Poultry Food, *T. D. Hall*. (S. Africa Jour. Dept. Agr., Oct., 1923, pp. 352-363.) [63.60432.]

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The Economics of Milk Recording, *James Wyllie*. (Scottish Jour. Agr., July, 1923, pp. 315-324.) [63.711(*b*).]

The Economic Value of Milk to the Producer, *A. G. Ruston* and *J. W. Dallas*. (Milk Industry, Oct., 1923, pp. 111-118.) [63.714; 63.7(42).]

The Comparative Value of Protein, Fat and Carbohydrate for the Production of Milk Fat, *E. J. Sheehy*. (Sci. Proc. Roy. Dublin Soc., XVII, 24, June, 1923, pp. 211-218.) [63.711(*a*).]

The Use of the Self-Feeder with Young Dairy Calves, *A. C. McCandlish*. (Jour. Dairy Sci., VI, 5, Sept., 1923, pp. 500-508.) [63.62(04).]

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Pasteurization of Milk for Cheddar Cheese-making. The Bacteriological Aspect, *J. K. Murray*. (N.S.W. Agri. Gaz., Aug., 1923, pp. 559-566.) [576-8 : 7.]

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The Agricultural Situation, *A. W. Ashby*. (Edinburgh Rev., April, 1923, pp. 369-385.) [338.1.]

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Standards of Production and Net Output on Scottish Farms, *A. W. Ashby*. (Scottish Jour. Agr., VI, 4, Oct., 1923, pp. 387-401.) [338.1; 63(41).]

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